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NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON DC
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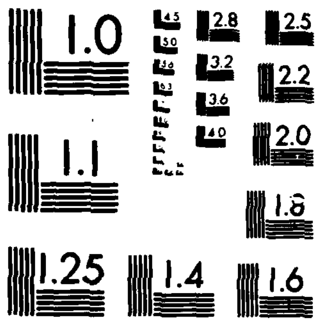

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PROGRAM STATUS REPORT

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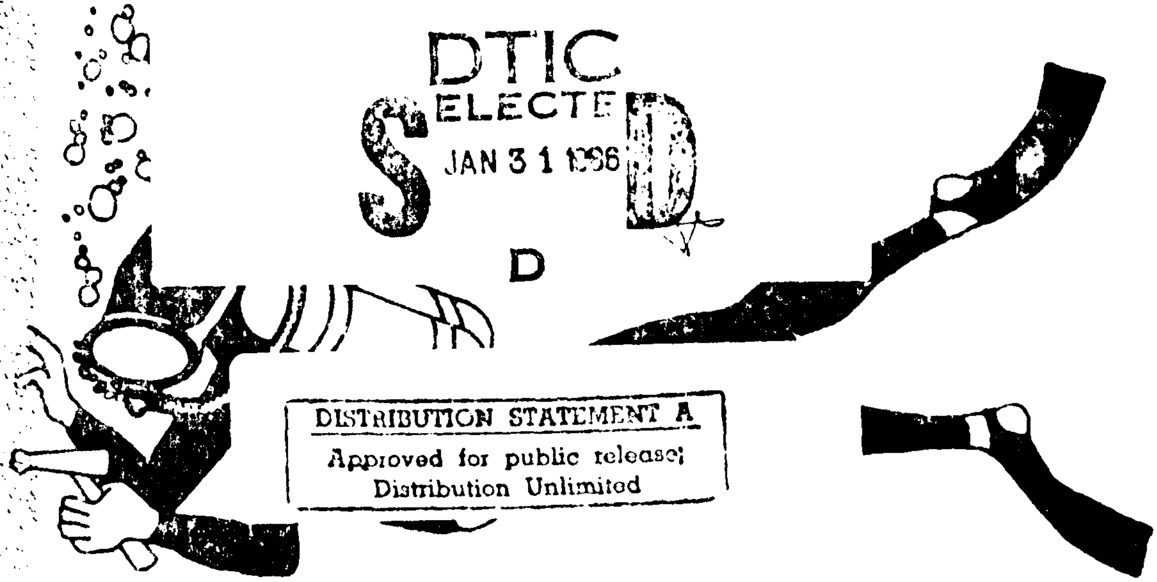

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U/W INSPECTION

PROGRAM STATUS REPORT

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Prepared for: Maintenance Division, Code 100
Naval Facilities Engineering Command
Alexandria, VA 22332

Under: Underwater Inspection Program
Subdivision of Specialized Inspection Program

By: Philip T. Scola
Program Manager, Underwater Inspection Program

Ocean Engineering and Construction Project Office
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The Chesapeake Division, Naval Facilities Engineering Command (CHESDIV) has managed the Underwater Inspection Program during its first two formative years gaining experience and acquiring data in that time. In the process, CHESDIV has developed some insight into the Navy's underwater inspection needs, (Con't)

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FOREWORD

The Chesapeake Division, Naval Facilities Engineering Command (CHESDIV) has managed the Underwater Inspection Program during its first two formative years gaining experience and acquiring data in that time. In the process, CHESDIV has developed some insight into the Navy's underwater inspection needs, and the scope of effort required to meet these needs. It now appears possible to foresee, in practical terms, the desirable characteristics of a permanent NAVFAC long range Underwater Inspection Program for Waterfront Facilities.

This status report summarizes CHESDIV accomplishments over the past two years, and provides information for planning a long range program. Some of the information in this report should be of use to the Navy Civil Engineering Laboratory, the Engineering Field Divisions and/or NAVFAC Codes 032 and PC-2. Following a review of this report by the program sponsor, Naval Facilities Engineering Command Code 100, CHESDIV will work with Code 100 on finalizing an updated program plan. This plan will be based on the data included in this report but will also incorporate applicable information and guidance from NAVFAC Code 100 and elsewhere.

In its operation, the Underwater Inspection Program is intended to be responsive to inputs from all concerned members of the NAVFAC community. Therefore any comments offered to improve the progam's effectiveness will be welcomed by CHESDIV; such comments should be directed to Philip T. Scola, Program Manager or Wade F. Casey, Project Engineer at Autovon 288-3881 or Commercial 202-433-3881.

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1. BACKGROUND

In the late 1970s it became evident to the Naval Facilities Engineering Command (NAVFACENGCOM) and to NAVOP 044 that the backlog of maintenance and repair (M&R) projects for the Navy's shore facilities was steadily increasing. The justification of waterfront facilities M&R needs and the development of requirements for future waterfront facilities had not been adequately documented. Historically, this had resulted in inadequate funding for both M&R and new construction. These M&R problems were dramatized by situations where planned fleet bething was found to be unsafe just prior to use, loading capabilities on fleet operational piers required drastic down rating, and catastrophic failure of some facilities necessiated costly replacement.

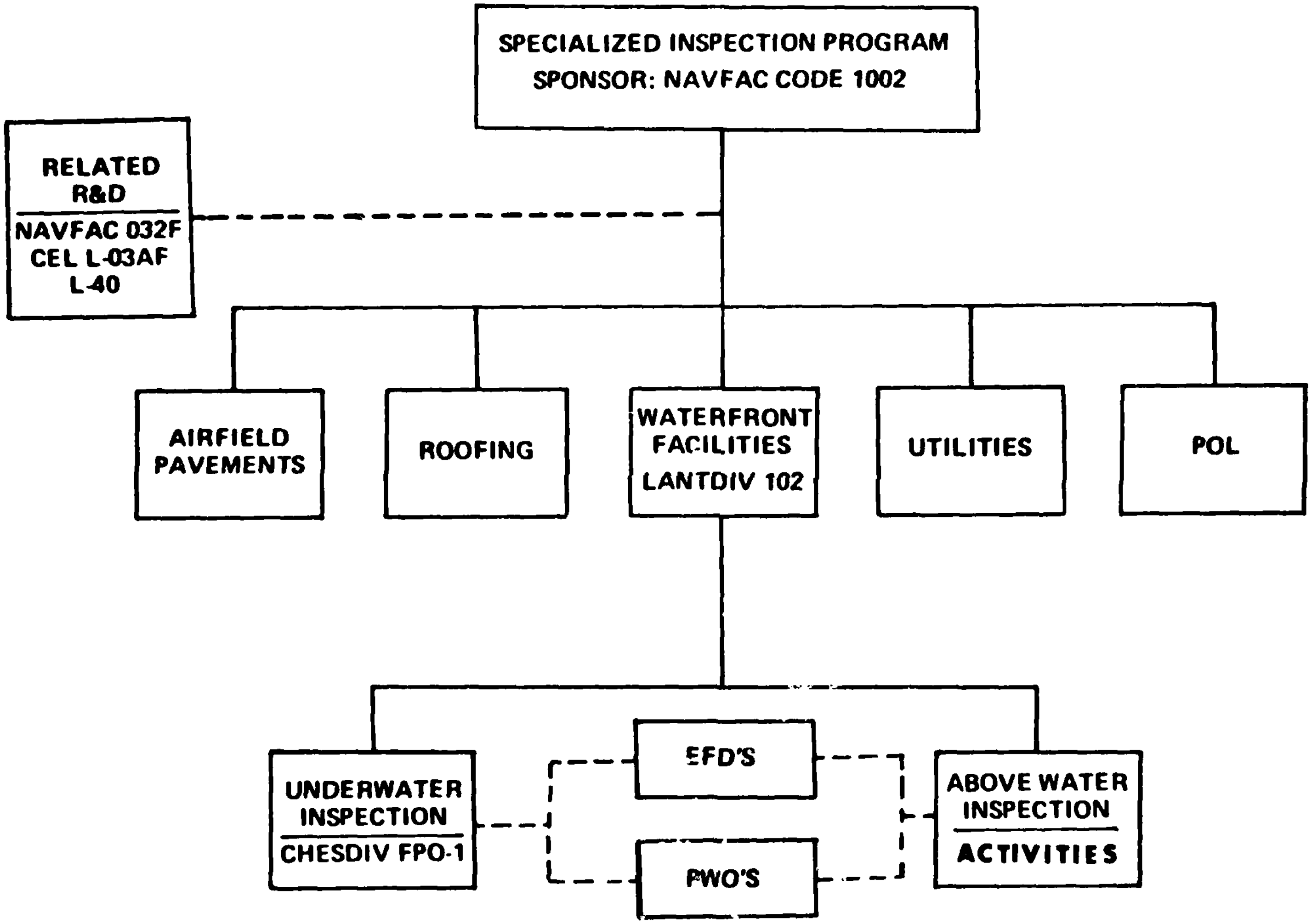
The components of waterfront facilities which have consistently received the least M&R, have been the underwater (U/W) structures. The adage "out of sight, out of mind," while applicable is only partly the reason. Engineering assessments of the structural condition of U/W components are necessary to assure future facility availability for fleet support and minimal M&R and replacement costs. These assessments require a level of specialized engineering expertise and equipment not always recognized by, or available to, the Public Works Offices (PWOs) at the Navy's many shore activities. Part of this problem derives from the fact that many U/W inspections have been purely visual observances (or "swim-bys") involving little or no U/W structure cleaning or measurements. Frequently the U/W inspectors have been well qualified as divers but minimally qualified in the areas of structural design and deterioration, corrosion, and damage of metal, concrete, and timber U/W structures. Divers, who traditionally have not been technically trained in structural engineering, may fail to recognize the indicators of structural deterioration and its significance to overall facility integrity. They are also unlikely to have the technical vocabulary to describe precisely some of the subtle structural anomalies encountered. Add to these factors the high cost of performing engineering level U/W inspections and structural assessments and it is not surprising that shore activities have often had inadequate knowledge of the physical condition of U/W structures and, consequently, have not provided adequate M&R.

In recognition of this situation Admiral Jortberg, of NAVOP 044, in FY 1980, succeeded in obtaining funds to set up a permanent program to address

special facilities M&R problems. The Specialized Inspection Program was established under the central management of NAVFACENGCOM, Maintenance Division (Code 100) to include a number of specialty areas requiring specialized inspections. One of these, waterfront facilities, was assigned to the Atlantic Division of NAVFACENGCOM, with the execution of the underwater inspections of those facilities assigned to the Ocean Engineering Project Office, Code FPO-1 at the Chesapeake Division, Naval Facilities Engineering Command. Figure 1-1 illustrates the relationship of the Underwater Inspection Program to other programs and participants in the Specialized Inspection Program.

Figure 1-1

NAVFAC INSPECTION PROGRAM ORGANIZATION



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2. PROGRAM OBJECTIVES

When NAVFACENGCOM, Code 100, the managing office for the Specialized Inspection Program, initially directed CHESDIV to undertake the Underwater Inspection Program, the objectives were simple and direct. CHESDIV was to perform an underwater survey of the Navy's underwater facilities, assess their physical condition, and report these assessments to NAVFACENGCOM, Code 100, the Engineering Field Divisions (EFDs), the activities Public Works Offices (PWOs), and the Public Works Centers (PWCs). During the early investigatory efforts in the program, through several data acquisition cycles, and by means of visits and inspections at Navy activities, further objectives of the long range program were identified. These included developing procedures for data acquisition, establishing a data inventory system, developing U/W inspection standards, and developing guidelines for U/W inspection cost estimates. These objectives can be delineated as follows:

1. Correct, update and expand part of the Naval Facilities Assets Data Base (NFADB) to establish an inventory of underwater waterfront facilities data.
2. Convert the completed data inventory into a computerized system.
3. Complete one full cycle of underwater inspections of all priority waterfront facilities as a part of the baseline survey.
4. Complete recommendations to activities on surveyed facilities:
   - o Structural conditions and load capabilities,
   - o Maintenance and repairs,
   - o Order of magnitude M&R costs.
5. Recommend NAVFAC standards for:
   - o Underwater inspection procedures,
   - o Underwater inspection techniques,
   - o Underwater inspection equipment,
   - o Underwater inspection data required,
   - o Underwater inspection reports.
6. For a permanent underwater inspection program establish trade-offs on:
   - o Selection of facilities to inspect,
   - o Types of underwater inspections,
   - o Frequency of underwater inspections,
   - o Yearly program budget.

It should be noted that the inspection cycle period in objective #3, the main part of the whole program, is highly dependent on the level of funding provided. More details on this subject are included in Sections 5 and 7 of this report.

3. FACILITIES DATA ACQUISITION AND ANALYSIS

3.1 Initial Search

Efforts to obtain data with which to start the underwater inspection program were concentrated upon three areas:

- o Maintenance and repair cost history and projections
- o Underwater facilities types, quantities, and distribution (by Investment Category, activities, and geographic location)
- o Physical conditions of waterfront facilities

The search for historical data on the yearly expenditures for underwater waterfront facilities (UWWF) maintenance and repairs (M&R), and on non-deferrable backlogs (BMAR) of such M&R was tedious, time-consuming, and frustrating. The data studied was obtained through the NAVOP-044 Real Property Maintenance Activity (RPMA) and is arranged in a number of budgetary categories, each of which lumps M&R expenditures and BMAR for the UWWF with similar data for many other types of Navy facilities. The Annual Inspection Summaries (AISs) written by each of the 256 Navy activities and submitted to their major claimants, are a primary source of M&R data and, like many sources, do not identify this data separately by category code. Additionally, evaluations had to be made of the data categorizations, such as levels of expenditures and deficiency codes, which cut across all facility categories. The accounting procedures render it impossible to extract automatically, by computer printout, only the partial data desired from each category. Therefore, manual extraction of this data is required, a costly effort which CHESDIV considered unwarranted.

Once this decision was made, program efforts were more productively concentrated on obtaining data of UWWF types, locations, physical condition, material, etc. The data sources utilized included the following:

- o NFADB - Naval Facilities Assests Data Base
- o NAVOP-044 RPMA Budget Submission Form PB-27
- o Shore Facilities Planning Board Booklet
- o Real Property Lists
- o AISs - Annual Inspection Summaries
- o Special Project Reports
- o MAGIC - Master Activity General Information and Control Records

- o NAVFAC P-78, NFADB Procedures Manual
- o NAVFAC P-72, Category Codes for Navy Facilities Assets
- o NAVOP-044 RPMA Shore Maintenance and Repair Trends
- o NAVOP-044 RPMA Shore Facilities Planning Board Report
- o Major claimants facilities and comptroller personnel
- o Engineering Field Divisions, Code 10 and 20
- o Activities Public Works Offices

The NFADB was the best data source available and was thoroughly studied, Unfortunately, the NFADB, like the RPMA M&R data systems studied before it, includes a great amount of data not pertinent to the Underwater Inspection Program and only separable by slow manual effort. Out of perhaps 2,300 facility category codes used in the NFADB and described in NAVFAC Manual P-72, forty-one (41) were singled out as constituting all of the types of UWWFs in the Navy inventory. Then, out of many thousands of data entries in the NFADB, about 2,800 entries were selected to form the UWWF data inventory.

The facilities inventory data is summarized in Figure 3.1-1. It provides little of the technical data required in the Underwater Inspection Program for its initial formation and presently required for planning future inspections. Such essential data as structural material (wood, concrete, steel, combinations), configuration, pile sizes and quantity, and water depth are basic requirements for planning inspections and estimating costs for fixed fee contracts and none of this data is included in the NFADB. The extent of errors and omissions in the NFADB was a major disappointment. One activity was listed as having 2,740 mooring platforms when, in fact, there were eight. Some known facilities were not included in the NFADB and many were incorrectly categorized by code number (wharfs and berths classified as piers, etc.). Many quantity listings were wrong. Some facilities are not longer usable but have not been excised. The types of errors are numerous.

The continued use of the NFADB alone in this program is not practical. It requires excessive manpower, is too costly, and does not provide necessary data handling capabilities such as timely data updating, retrieval, analysis, and summarization. A modern computerized UWWF data inventory system, which would provide these cost effective capabilities, is proposed and described in Section 8.

Figure 3.1-1

SUMMARY FROM SURVEY OF NAVY U/W WATERFRONT FACILITIES DATA+

FACILITY NOMENCLATURE (NO. OF SUB-CLASSIFICATIONS)	FACILITY CATEGORY CODE	INVESTMENT CATEGORY	TOTAL NO. OF FACILITIES	NUMBER OF GEOGRAPHIC LOCATIONS	FACILITIES AREA (SQ. YDS.)	FACILITIES LENGTH	REPLACEMENT COST IN 1980 ($M)
MARINE FUEL DISPENSING (2)	122	03	76	27	–	–	16.8
POL PIPELINE (0)	125–10	10	274	89	–	1,690MI	604.
SHIP AND OTHER OPER FAC/OTHER THAN BLDGS (2)	148	04	4	2	11,709	–	1.9
PIERS (9)	151	03	336	69	2,004,640	412,127FB	1,794.8
WHARFS (9)	152	03	189	43	2,583,823	167,308FB	1,011.7
SEAWALLS, BULKHEADS, AND QUAY WALLS (4)	154	03	214	67	–	748,790LF	753.
SMALL CRAFT BERTHING (3)	155	03	169	66	–	63,001FB	667.
OTHER WATERFRONT OPER FACILITIES (2)	159	03	108	30	–	–	69.
FIXED MOORINGS (3)	163	03	718	93	–	–	49.1
U/W TRACKING/TRAINING RANGE (0)	179–72	05	4	1	–	–	–
DRYDOCK (0)	213–10	07	64	15	513,352	28,103LF	1,868.
MARINE RAILWAY (0)	213–20	07	23	18	–	26,213LF	64.
SENSOR ACCUR. CHECK SITE (0)	217–50	08	8	4	–	–	2.
MARINA (0)	750–60	16	175	53	–	–	17.
OUTFALL SEWER LINE (0)	831–20	17	127	30	–	–	32.
VEHICULAR BRIDGES (0)	851–20	18	332	90	215,513	58,914	113.
RR BRIDGE/TRESTLE (0)	860–30	18	67	27	–	6.6MI	69.
TOTAL							7,130.5

FB – FT. OF BERTHING, LF – LINEAR FT., MI – MILES

+ – INCLUDES FACILITIES IN INVESTMENT CATEGORY (I.C.) 03 AND (11) FACILITY CATEGORY CODES IN (8) OTHER I.C.'s

3.2 Mail Data Survey

Early in the program it became obvious that much more information than that contained in the NFADB was required. The best sources of additional information were the activities responsible for waterfront facilities operation, maintenance, and repair. Telephone inquiries were made to several of these activities and some twenty personal visits were made. The telephone calls and visits provided much supplemental detailed information.

The total number of activities with UWWFs was in excess of 250 and therefore a mail survey was the logical means of acquiring the major amount of the needed data. Accordingly, a standard Underwater Facilities Questionnaire (UFQ) was formulated. The first draft of this quentionnaire was sent to several of the activities to which personal visits were to be made so that their suggestions for improvement could be included in the final draft of the UFQ. The letter forwarding the UFQ to selected activities requested supplemental documentation such as corrected NFADB data sheets, facilities plan views and cross sections, pile plans, an overall activity site plan, and bathymetric charts. Samples of the completed UFQ forms are given in Figures 3.2-1, 3.2-2, and 3.2-3.

These UFQs were mailed to 92 activities with high mission priorities. The selection of these activities is described in sub-section 3.3 and they are identified in Figure 3.4-1. The initial UFQ mailing resulted in responses from less than 50% of the activities. In the 1-1/2 years since the first UFQ mailing two more mailings and follow-up telephone calls have raised the overall response to 82%.

Figure 3.2-1

Underwater Facility Questionnaire (UFQ)

See instruction sheet for assistance in filling out this UFQ.

User Activity NAS C.C. TEX. Date JULY 1980

Your Name ______ Code ______ Phone ______

Facility Name FINGER PIERS.

Facility Number 2-01850-1851-1852 Category Code 155-20

Present Type Use PERMANENT

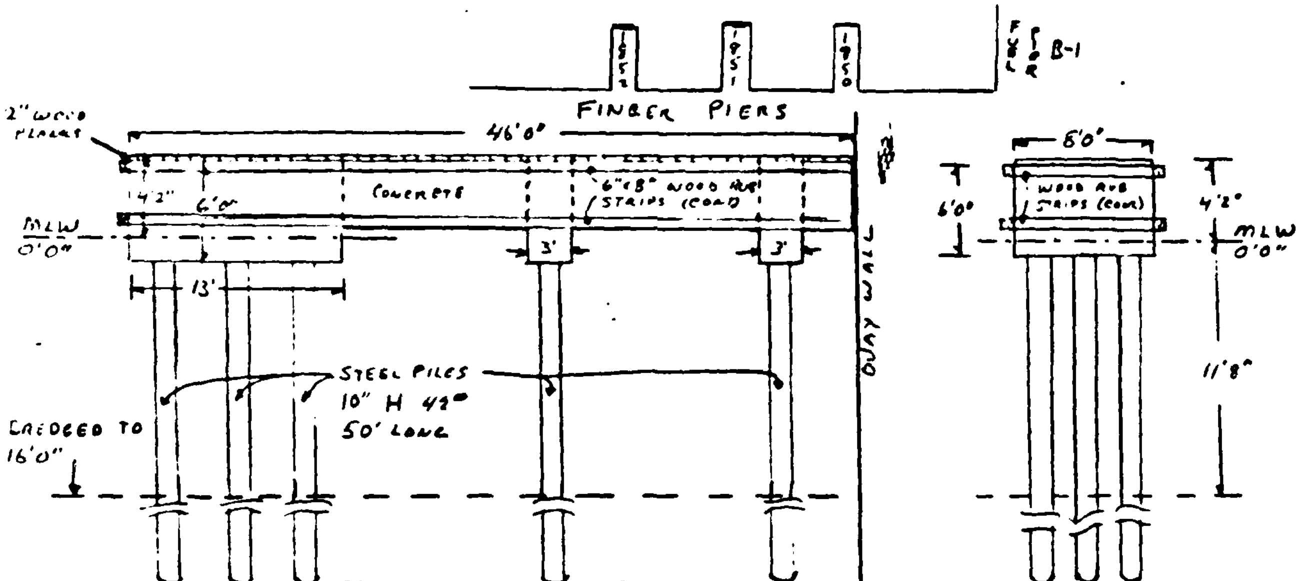
Facility Usage: Heavy ______ Moderate ______ Light X

Crane Rails Present? Yes ______ No X Capacity ______

Facility Size (ft.): Length 46' Width 8' Height 4'

Elevation of: Facility Top + 4'2" MLW 0'0" MHW ______

Facility Shape (sketch roughly) Area (sq. ft.) ______



TYPICAL FINGER PIER

Number of bearing piles (if applicable) 15 EA 50' H 42# STEEL

% of types of material in water: Steel 85% Wood 0

Concrete 15% Other (describe) ______

Last Eng'g Evaluation Date 0 U/W Inspection? Yes ___ No X

Above-Water Inspection performed by MCD INSPECTORS

Date of last maintenance on in-water portions over $15,000 —

Additional Comments 1851- WOOD DECKING REPLACED 1975 NO MAINT ON 1850-1852 WOOD DECKING DONE ON BOTH PIERS

Figure 3.2-2

Underwater Facility Questionnaire (UFQ)

See instruction sheet for assistance in filling out this UFQ.

User Activity NAS CC TEX – CCAD Date JULY 1980

Your Name ______ Code ______ Phone ______

Facility Name BULKHEAD (QUAY WALL)

Facility Number 2-01050 Category Code 154-30

Present Type Use PERMANENT

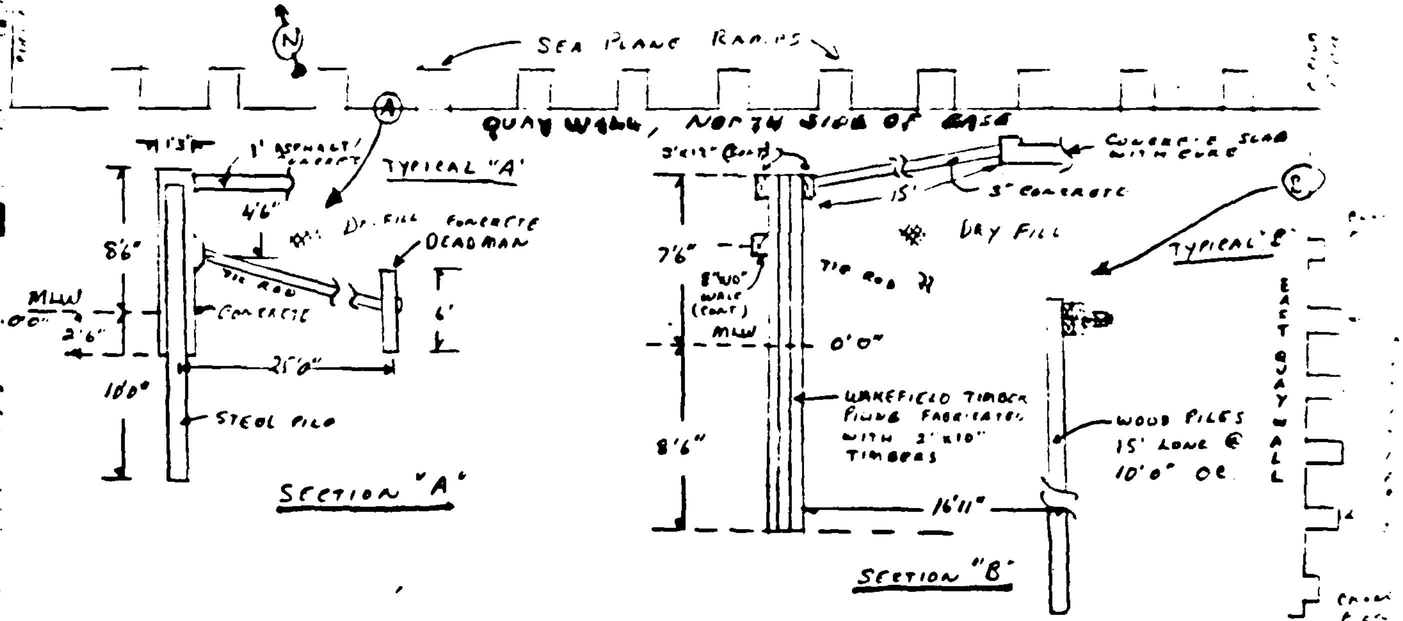
Facility Usage: Heavy ______ Moderate ______ Light ______

Crane Rails Present? Yes ______ No ______ Capacity ______

Facility Size (ft.): Length 19796.4' Width 15" Height 16'–18.5'

Elevation of: Facility Top 7.5'–8.5' MLW 0'0" MHW ______

Facility Shape (sketch roughly) Area (sq. ft.) ______



Number of bearing piles (if applicable) ______

% of types of material in water: Steel (A) 80% (B) 0% Wood (B) 100%

Concrete (A) 20% (B) 0% Other (describe) ______

Last Eng'g Evaluation Date NONE U/W Inspection? Yes ___ No X

Above-Water Inspection performed by MCD INSPECTORS

Date of last maintenance on in-water portions over $15,000 NONE

Additional Comments DRY FILL WASHING FROM UNDER AIRCRAFT PARKING APRON/TAXIWAY ALONG NORTH QUAYWALL (SECTION A) EAST QUAYWALL COMPLETELY DETERIORATED (SECTION B)

Figure 3.2-3

Underwater Facility Questionnaire (UFQ)

See instruction sheet for assistance in filling out this UFQ.

User Activity NAF Atsugi (Special area) Date 1 May 1980

Your Name S. ICHIOKA Code 183 Phone 228-3143

Facility Name Genl Purp/Berthing Wharf

Facility Number 5001 Category Code 152-20

Present Type Use Supply wharf

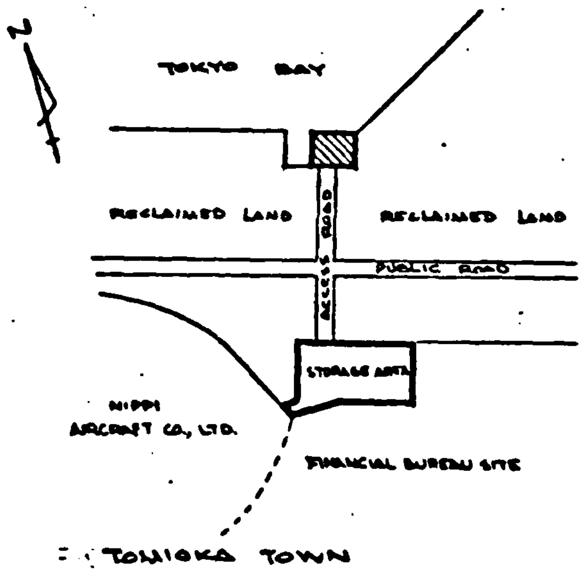
Facility Usage: Heavy ____ Moderate ____ Light X

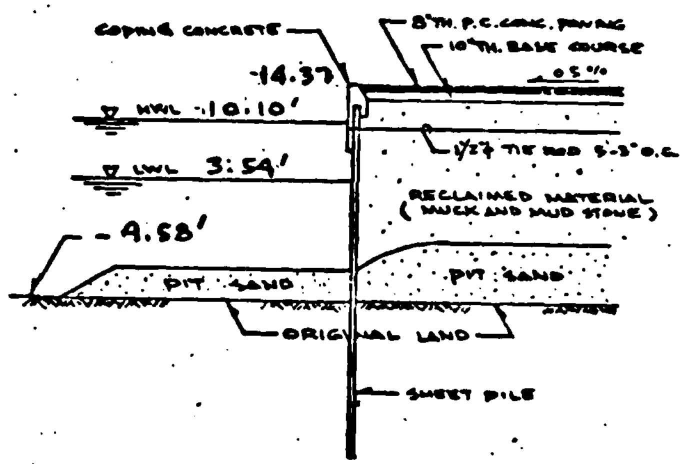
Crane Rails Present? Yes X No ____ Capacity 25 Tons

Facility Size (ft.): Length 262.47' Width 196.85' Height NA

Elevation of: Facility Top 14.37' MLW 3.54' MHW 10.10'

Facility Shape (sketch roughly) Area (sq. ft.) 51.667





SHEET PILE USP II { L=36.09 243 SHEETS; L=39.37 153 "

Number of bearing piles (if applicable) " " USP III L=39.37 200 "

% of types of material in water: Steel 85 Wood ____

Concrete 15 Other (describe) ____

Last Eng'g Evaluation Date May 1977 U/W Inspection? Yes ____ No X

Above-Water Inspection performed by PACNAVFACENGCOM

Date of last maintenance on in-water portions over $15,000 ____

Additional Comments The facility is located at Tomioka. It is used by COMFAIRWESTPAC and maintained by NAF Atsugi.

3.3 Facilities Selections for Underwater Inspections

After completing the first summarization of UWWF data in the NFADB, a facilities selection analysis was performed. This proved to be a major influence in establishing a long range plan for the program. The high priority UWWFs were found to be unevenly distributed geographically. This fact proved to be significant since the 3,408 UWWFs in the NFADB were too numerous for funding as a part of the Specialized Inspection Program.

This analytical process of selecting facilities to be inspected is summarized in Figure 3.3-1. Starting with the 3,408 UWWFs, whose replacement cost was estimated at $8.5B, the selection process also applied the criteria and followed the logic illustrated in Figures 3.3-2 and 3.3-3, to help narrow the selection to 1,220 high priority facilities, with a replacement value of $4.5B.

In the first selective step of this process the facilities in Investment Category 03 were assigned a higher priority than the facilities in all the other eight Investment Categories (I.C.s). Some of the non-03, I.C. facilities were already part of specially funded inspection programs, or were planned to be; some were used very little; some categories included unknown percentages of facilities out of water; and some types of facilities will require as yet unavailable techniques and equipment to locate and inspect areas of deterioration.

In the next selective step, 42% of the I.C. 03 facilities were weeded out for similar reasons. This brought the total candidate facilities down to 1,470 which, if the probability of high level funding were greater, would have comprised the selected facilities. However, due to lower funding expectations, another reduction of choices was made to exclude all except four facility categories - piers, wharfs, small craft berthing and, as one category, quaywalls, seawalls, and bulkheads. This lowered the total number of facilities in the program to 1,220 which is considered a reasonable balance between the maximum effort manageable with the available manpower and fiscal resources, and the minimum number of facilities essential to fleet support.

At this point in the process, the irregular geographic distribution of these facilities presented an opportunity to improve cost effectiveness by postponement of less cost efficient portions of the program. As Figure 3.3-4 illustrates, it is possible, by being very selective, to inspect 82% of the

1,220 facilities at only 36% of the 256 activities locations. Figure 3.3-5 indicates that this selectivity provides even greater efficiency (90%) in terms of linear feet and feet of berthing handled by inspecting the same particular 92 activities.

At present the Underwater Inspection Program is concentrating most of its efforts on these 92 activities and the four categories of facilities to perform the UFQ survey, inventory the data, and perform the U/W inspections and assessments.

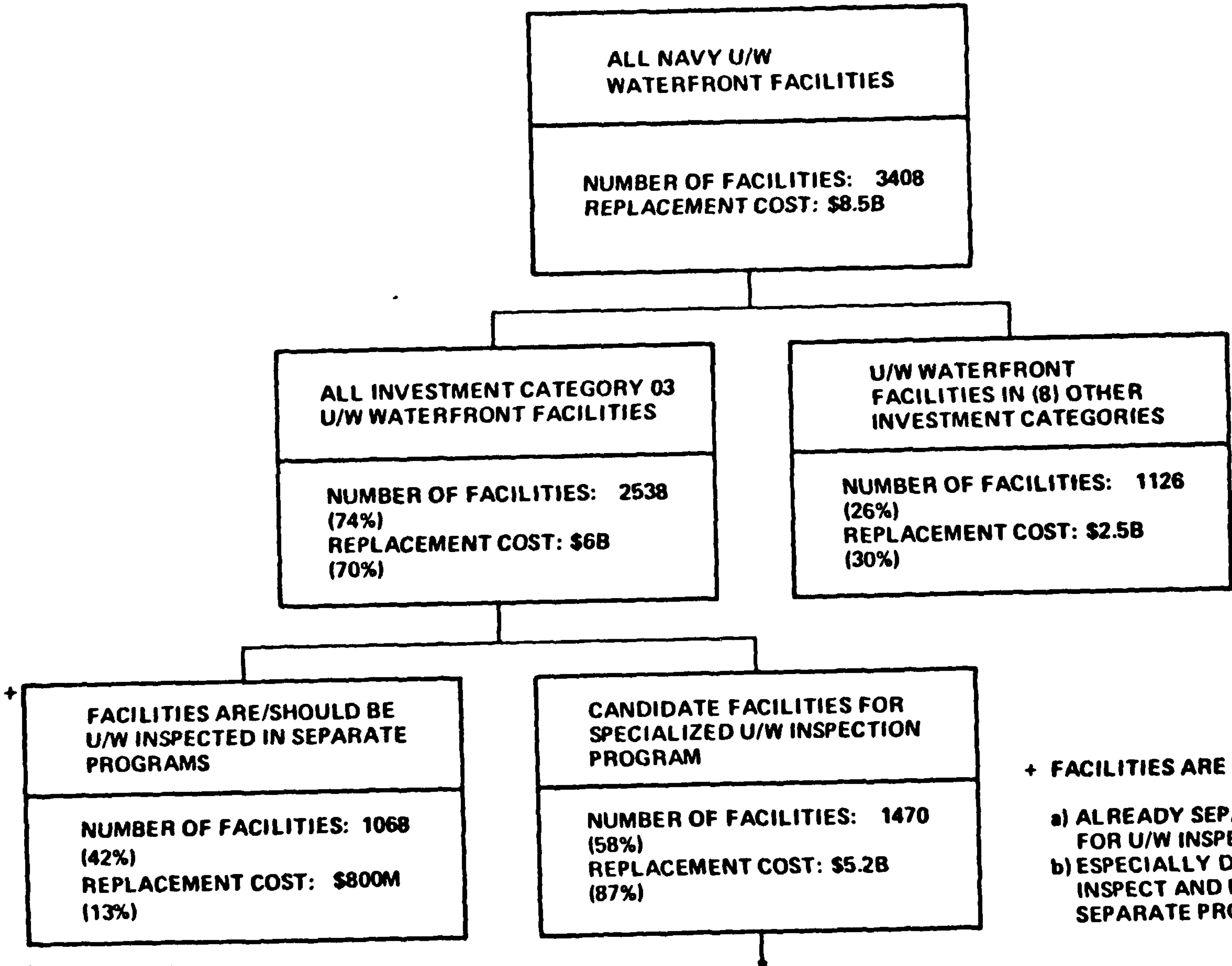
Figure 3.3-1
WATERFRONT FACILITIES PRIORITIES FOR U/W INSPECTIONS

NAVFAC NOMENCLATURE	INVESTMENT CATEGORY	REPLACEMENT COSTS ($M)	% OF TOTAL	FACILITY SIGNIFICANCE TO U/W INSPECTION PROGRAM
MARINE FUEL DISPENSING	03	16.8	0.24%	MOSTLY OUT-OF-WATER EQUIP. V. SMALL % IN-WATER STRUCTURES
POL PIPE LINE	03	604.	8.5%	MOSTLY OUT-OF-WATER. HARD TO LOCATE.
NUCLR PROP. SUP. FAC	04	.8	.01%	WILL BE INSPECTED AS PART OF SEPARATELY FUNDED PROGRAM.
NUCLR WPNS HANDL FAC	04	1.1	.02%	WILL BE INSPECTED AS PART OF SEPARATELY FUNDED PROGRAM.
*PIERS	03	1794.8	25.1%	MOSTLY HIGH PRIORITY USE AND INADEQUATELY FUNDED.
*WHARFS	03	1011.7	14.1%	MOSTLY HIGH PRIORITY USE AND INADEQUATELY FUNDED.
*SEA/QUAY WALLS, BULKHDS	03	753.0	10.5%	MOSTLY HIGH PRIORITY USE AND INADEQUATELY FUNDED.
FLEET LANDING	03	516.	7.2%	VERY LOW PRIORITY. PERSONNEL CAN LAND ANYWHERE.
*SMALL CRAFT BERTHING	03	151.	2.1%	MOSTLY HIGH PRIORITY USE AND INADEQUATELY FUNDED.
OTHER WATERFRONT OP. FAC	03	69.	1.%	PLANE DOCKING AND LANDING CRAFT RAMPS ARE SELDOM USED AT ALL.
FIXED MOORINGS	03	49.1	.7%	
MOORING DOLPHIN	03	–	–	MOST ARE DAMAGED OFTEN AND REPAIRED OR REPLACED OFTEN.
MOORING PLATFORM	03	–	–	MOST ARE DAMAGED OFTEN AND REPAIRED OR REPLACED OFTEN.
STAKE PILE MOORING	03	–	–	ARE FLEET MOORINGS. SEPARATELY FUNDED PROGRAM.
U/W TRACKING/TRNG. RG.	03	–	–	SEPARATELY FUNDED FOR FPO-1.
DRYDOCK	07	1868.	26.2%	SEPARATELY FUNDED AND INSPECTED BY SHIPYARD DIVERS.
MARINE RAILWAY	07	64.	.9%	ONLY PARTLY IN WATER. MOST ARE NOT IN USE AT ALL.
SENSOR ACCUR. CHECKSITE	08	2.	.03%	WILL BE SEPARATELY FUNDED FOR FPO-1.
MARINA	16	17.	.24%	NOT OF MILITARY VALUE.
OUTFALL SEWER LINE	17	32.	.45%	LOCATIONS ARE VAGUE, DIFFICULT TO FIND AND INSPECT, REQUIRE SPECIAL TECHNIQUES AND EQUIP. NEED SPEC. PROG.
VEHICULAR BRIDGES	18	113.	1.6%	MANY NOT IN WATER.
RAILROAD BRIDGE/TRESTLE	18	69.	1%	MANY NOT IN WATER.
TOTAL		7132.3	100%	

*THESE FOUR CATEGORIES CONSTITUTE OVER 50% OF TOTAL REPLACEMENT COSTS FOR ALL WATERFRONT FACILITIES. THESE FOUR CATEGORIES CONSTITUTE OVER 85% OF THE INVESTMENT CATEGORY 03 WATERFRONT FACILITIES.

Figure 3.3-2a

FACILITIES SELECTION PROCESS FOR U/W INSPECTION

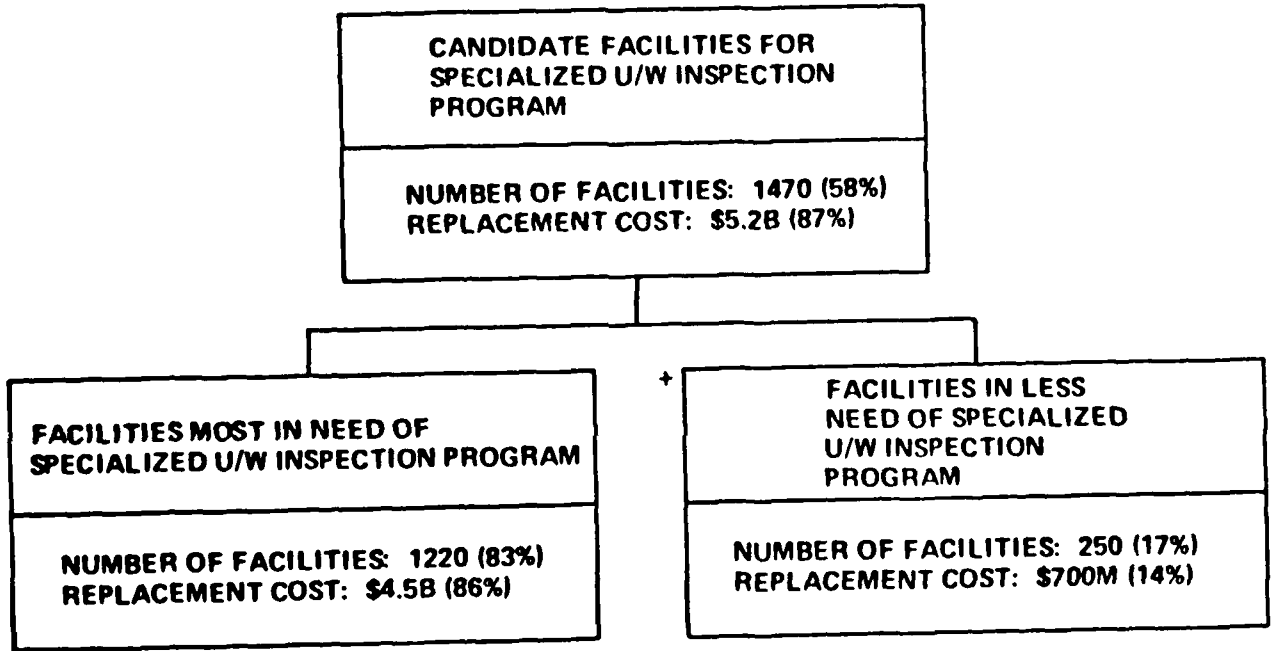


\+ FACILITIES ARE CATEGORIZED AS:

a) ALREADY SEPARATELY FUNDED FOR U/W INSPECTIONS
b) ESPECIALLY DIFFICULT TO U/W INSPECT AND NEED SPECIAL SEPARATE PROGRAM

Figure 3.3-2b

FACILITIES SELECTION PROCESS FOR U/W INSPECTION (CONT'D)



+ FACILITIES ARE CATEGORIZED AS:

a) REPAIRED OR REPLACED OFTEN AND NOT COST EFFECTIVE IN PROGRAM
b) MOSTLY OUT OF WATER
c) HAVE LOW PRIORITY
d) MOSTLY NOT USED

Figure 3.3-3

FACILITIES SELECTION FOR U/W INSPECTION

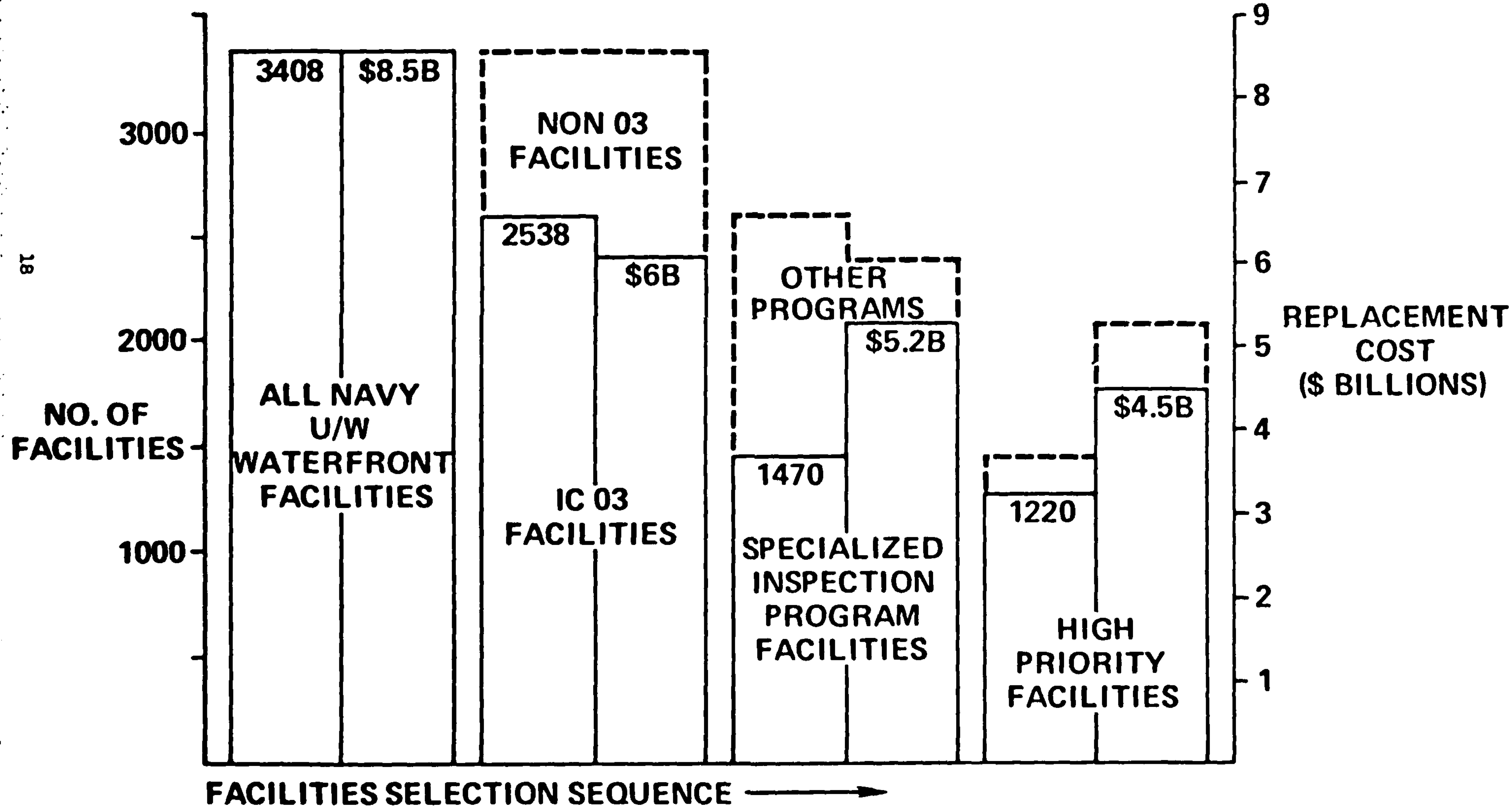


Figure 3.3-4

WATERFRONT FACILITIES INCLUDED IN U/W INSPECTION PROGRAM
(IN NUMBER OF FACILITIES)

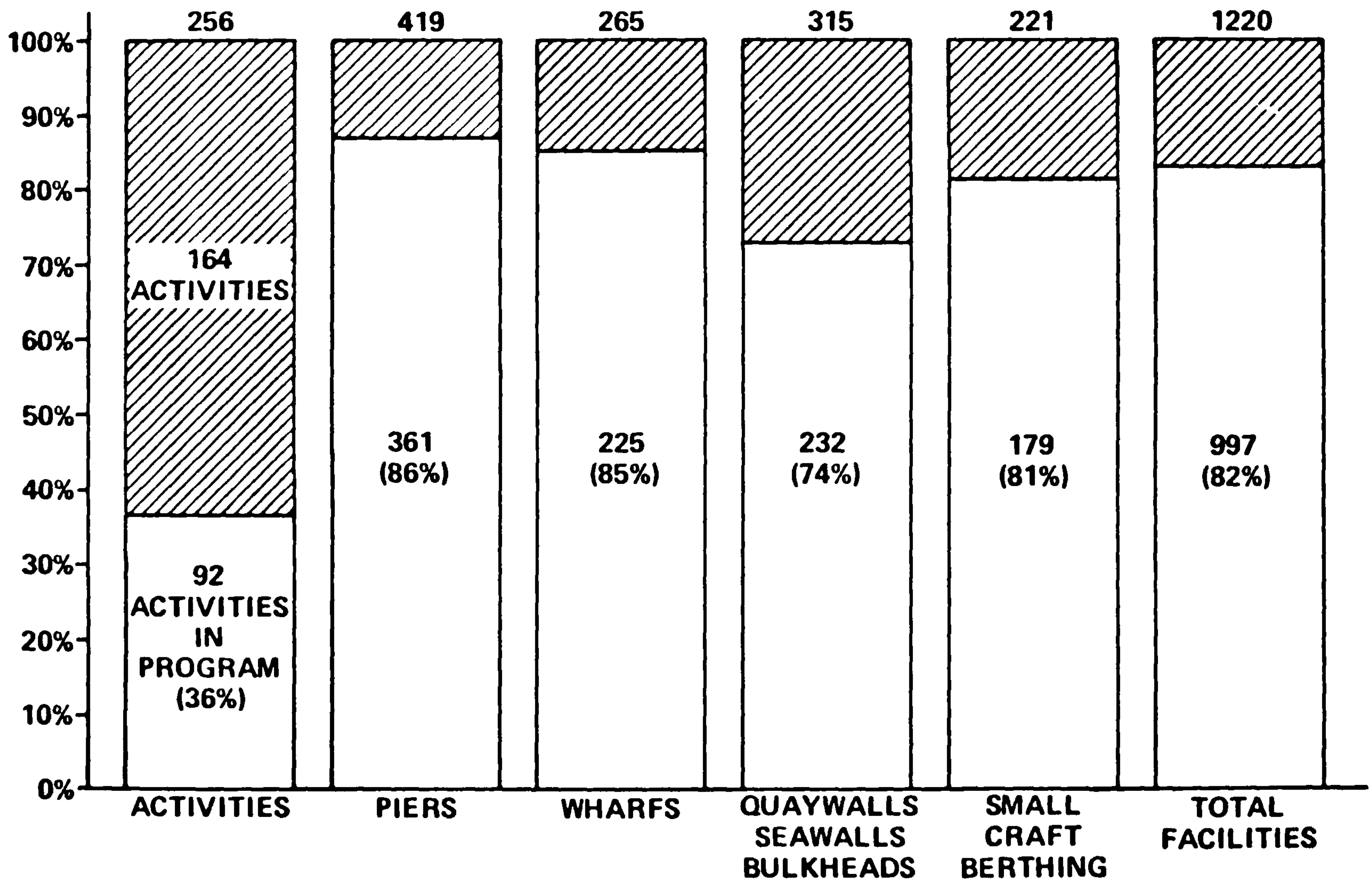
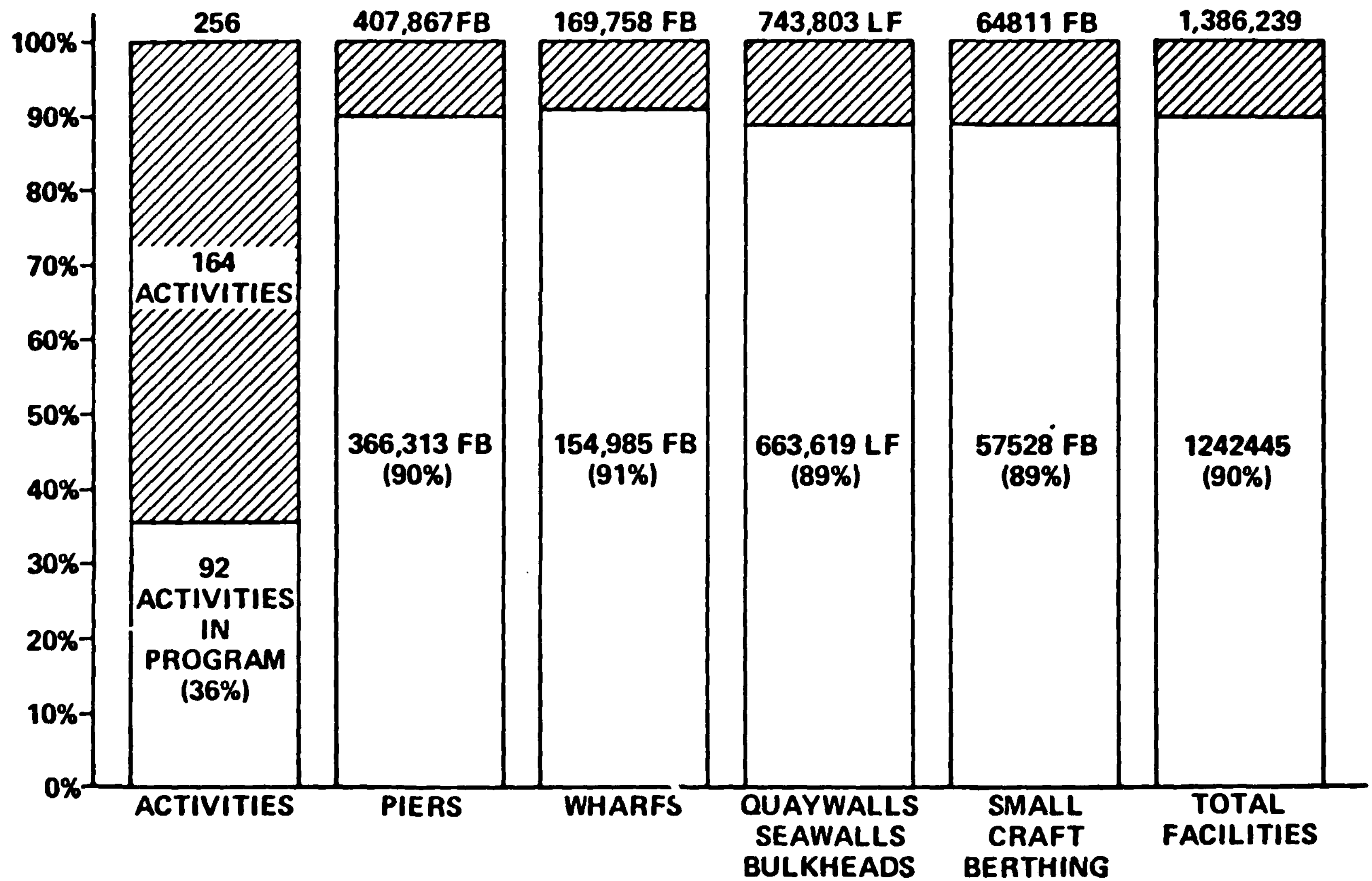


Figure 3.3-5

WATERFRONT FACILITIES INCLUDED IN U/W INSPECTION PROGRAM
(IN LINEAR FEET/FEET OF BERTHING)



3.4 Data Summaries

A considerable amount of facilities data has been obtained, analyzed, and summarized over the past two years and this process is continuing. While periodic corrections and additions preclude any near term "final" summarization, it is nevertheless worthwhile to summarize the data on hand at this point in order to provide a basis for planning the future course of the Underwater Inspection Program. For the above reasons some inconsistencies may appear where data is repeated in different parts of this report. Such occurrences result from analyzing the data at different times relative to updating. The more times this data is corrected and updated the more likely it will truly represent the Navy's UWWFs.

Figure 3.4-1 identifies the 92 high priority activities selected for the program's baseline survey of U/W inspections. Quantifications of the four high priority categories of facilities selected are provided for each of these activities. Every facility represented by these summaries is targeted for an U/W inspection and gross structural assessment in the initial inspection cycle which constitutes the baseline survey. Activities are grouped in 17 geographical areas for which grouping criteria were arbitrarily created. Each activity was included in the Underwater Facility Questionnaire (UFQ) survey conducted by CHESDIV.

The summaries of facility lengths in Figure 3.4-2 are indicative of the scope of the program. The task of underwater inspecting 77 miles of piers, wharfs, and 141 miles of bulkheads, quaywalls, etc. is awesome. Also, if the $4.5 billion replacement cost in Figure 3.4-2 is compared with the NAVFAC Underwater Inspection Program budget for FY 81 of $306,000 it is evident that even over a 10 year inspection cycle period at that rate of support the total expenditure for U/W inspecting the UWWFs would amount to less than .1% of the facilities' current plant value.

The data presented in Figures 3.4-3 through 3.4-9 are self-explanatory and further describe the distribution of these facilities.

Figure 3.4-1a

FLEETWIDE WATERFRONT STRUCTURES
GROUPED BY GEOGRAPHIC AREAS

	Piers		Wharfs		Sea Walls, Quay Walls, Bulkheads		Small Craft Berthing	
Geographic Areas	Qty.	*FB	Qty.	*FB	Qty.	#LF	Qty.	*FB
1. NORFOLK (8)								
NAVSTA	13	35,619	1	1183	11	27,669	10	7300
Amphib Base	21	17,780	1	1959	5	9007	41	12325
Shpyd (Ports)	14	17,745	9	7996	17	7815	9	2327
Sup Ctr (Wlmsbg)	2	3855	0	—	0	—	0	--
Sup Ctr (Norfolk)	3	3100	2	1440	1	18,765	1	250
Wpns Sta (York)	0	--	1	4650	0	—	0	--
NAS	0	--	2	1149	6	26,050	1	365
Com. Area Mstr Sta	0	--	0	--	1	9359	0	--
2. SAN FRAN-OAKLAND (8)								
Supvr Shpbldg (San)				INACTIVE				
Supp Act (San)	5	5780	1	300	1	18,690	2	750
Sup Ctr (Oakland)	3	6324	4	6131	0	—	0	—
Supp Act (Vallejo)	1	5980	0	--	0	—	0	—
Shpyd (Vallejo)	7	7391	1	513	11	12,295	0	--
NAS (Alameda)	4	6280	2	1182	2	33,156	0	--
Wpns Sta (Concord)	4	5515	0	--	0	—	6	4200
Comm Sta (Stockton)	4	1460	10	6303	0	—	1	23
3. Miscellaneous (8)								
NAVSTA (Adak)	3	2910	0	--	2	13,970	1	274
NAVSTA (Rota)	2	3896	2	1787	1	2610	2	1375
Air Fac (Midway)	3	3354	0	--	1	18602	2	766
Adm Supp (Bahrain)	0	--	0	--	0	—	0	--
NAS (Bermuda)	4	1424	2	520	5	21,772	1	100
FAC (Argentina, New Fndld)	0	--	4	4224	2	5350	0	—
NAS (Corpus Cristi)	0	--	0	--	1	19,796	4	582
NTC (Great Lakes)	0	--	0	--	6	5805	3	1340

*FB - Feet of Berthing

#LF - Linear Feet

Figure 3.4-1b

FLEETWIDE WATERFRONT STRUCTURES
GROUPED BY GEOGRAPHIC AREAS

	Piers		Wharfs		Sea Walls, Quay Walls, Bulkheads		Small Craft Berthing	
Geographic Areas	Qty.	FB	Qty.	FB	Qty.	LF	Qty.	FB
4. JAPAN (5)								
Fleet Act (Yokos)	5	3848	2	171	5	50,457	3	176
Fleet Act (Okin)	2	3200	0	--	2	3230	1	450
Ord Fac (Sasebo)	3	200	13	6416	2	28,747	3	600
Sub Depot (Yokos)	0	--	24	3916	8	38,839	1	20
Air Fac (Atsugi)	0	--	2	589	1	21,360	0	--
5. SAN DIEGO (8)								
NAVSTA	16	33,880	0	--	10	17,132	0	--
Amphib Base	18	9098	0	--	2	4556	0	--
Sup Ctr	2	4000	1	1830	1	851	0	--
Sub Supp Fac	3	3252	1	170	3	2010	0	--
NAS	10	2813	1	3325	2	4890	4	2022
NOSC	2	2929	0	--	1	430	2	1000
Flt Anti-Sub WTC	3	1772	0	--	1	1148	2	843
NTC	0	--	0	--	1	3774	2	62
6. PEARL - HI (6)								
Shipyd	14	6641	17	6035	1	582	1	40
NAVSTA	4	3974	20	10827	9	3304	7	855
Sup Ctr	2	3931	11	4860	5	2339	0	--
Sub Base	3	1866	3	3991	0	--	6	818
Magazine (Lualualei)	0	--	6	3000	0	--	1	194
Missile Range Fac	0	--	0	--	0	--	0	--
7. CHARLESTON (4)								
NAVSTA	12	14,388	0	--	5	8443	5	1685
Shipyd	7	9840	2	1597	5	4188	0	--
Wpn Sta	5	5944	2	2530	3	2830	3	394
Sup Ctr	2	2334	0	--	0	--	0	--

Figure 3.4-1c

FLEETWIDE WATERFRONT STRUCTURES
GROUPED BY GEOGRAPHIC AREAS

	Piers		Wharfs		Sea Walls, Quay Walls, Bulkheads		Small Craft Berthing	
Geographic Areas	Qty.	FB	Qty.	FB	Qty.	LF	Qty.	FB
8. CT-RI-NH (5)								
Sub Base (New Lond)	12	8640	0	--	1	6690	2	1704
NETC (Newport)	4	8006	1	127	6	6093	2	914
NUSC (Newport)	10	5516	1	520	2	2926	5	815
Shipyd (Ports)	1	580	2	5620	1	300	0	--
Const Bat (Davisville R.I.)	0	--	0	--	2	1100	0	--
9. CARIBBEAN (3)								
NAVSTA (GITMO)	13	7273	8	2977	4	1463	5	1063
NAVSTA (Roos Rds)	6	5936	3	4316	10	7919	5	2586
NAVSTA (Canal Zone)	4	3254	0	--	1	516	0	--
10. DC-MD-VA (8)								
NSWC (Solomons)	2	1824	0	--	1	2500	1	112
NSWC (Dahlgren)	4	2252	0	--	1	850	0	--
Dis Cmd (Wash.)	7	3280	1	65	3	12,072	0	--
NAVSTA (Annapolis)	3	976	0	--	2	4939	0	--
Academy (Annapolis)	4	580	2	1024	2	16,440	0	--
NATC (Pax River)	1	172	1	150	3	17,290	6	825
Lab (Wash., D.C.)	1	153	1	170	4	10,401	0	--
NSRDC (Bethesda)	0	--	0	--	2	3520	3	548
11. LA-LONG BEACH (15)								
Shipyd (Long Beach)	4	9347	1	2960	2	4980	1	400
NAVSTA (Long Beach)	7	8082	0	--	1	2778	0	--
Wpns Sta (Seal Bch)	2	115	2	1000	0	--	1	450
Constr Battalion (Pt. Hueneme)	2	84	9	4275	1	4640	4	944
Missile Test Ctr (Pt. Mugu)	1	19	0	--	1	3431	0	--

Figure 3.4-1d

FLEETWIDE WATERFRONT STRUCTURES
GROUPED BY GEOGRAPHIC AREAS

	Piers		Wharfs		Sea Walls, Quay Walls, Bulkheads		Small Craft Berthing	
Geographic Areas	Qty.	FB	Qty.	FB	Qty.	LF	Qty.	FB
12. SEATTLE-BREM. (8)								
Shipyd (Bremerton)	17	17,130	0	--	7	8026	0	--
Sup Ctr (Bremerton)	2	2360	0	--	0	--	1	840
Supp Act. (Seattle)	2	1700	0	--	1	1000	0	--
NAS (Whidbey Is)	2	1260	1	181	1	6180	0	--
Sub Base (Bangor)	1	1500	1	1460	2	1203	0	--
Undersea Warfare Engr. Sta (Key)	2	955	0	--	3	5310	3	2127
TRIDENT REFIT FAC	3	2380	0	--	0	--	0	--
SWFPAC (Bangor)	0	--	1	640	0	--	0	--
13. PHILADELPHIA (3)								
Shipyd	11	12,416	17	12,154	2	6915	0	--
Wpn Sta (Colts Neck, NJ)	2	3960	0	--	0	--	0	--
Supp Act	1	406	0	--	1	7950	0	--
14. SO.GA.-NO.FL. (5)								
NAS (Pensacola)	3	2942	0	--	8	14,200	0	--
NAS (Jax)	2	1496	0	--	2	7741	1	1424
CSC (Panama City)	3	255	0	--	2	3278	0	--
NAVSTA (Mayport)	2	145	7	5253	1	3721	1	250
Sub Supp Base (Kingsland, GA)	0	--	1	1967	0	--	0	--
15. GUAM (3)								
Ship Rep Fac	1	650	6	3251	1	660	0	--
Sup Depot	0	--	6	7588	0	--	0	--
NAVSTA	0	--	4	5704	2	8400	1	370

Figure 3.4-1e

FLEETWIDE WATERFRONT STRUCTURES
GROUPED BY GEOGRAPHIC AREAS

	Piers		Wharfs		Sea Walls, Quay Walls, Bulkheads		Small Craft Berthing	
Geographic Areas	Qty.	FB	Qty.	FB	Qty.	LF	Qty.	FB
16. PHILLIPINES (6)								
Sup Depot (Subic)	2	3000	0	--	0	--	0	--
Ship Rep Fac (Subic)	5	1885	3	7065	1	4474	0	--
Magazine (Subic)	1	130	2	1050	1	500	0	--
NAVSTA (Subic)	1	20	2	3145	3	5005	1	125
NAS (Cubi)	0	--	0	--	1	15,400	0	--
PWC (Subic)	0	--	0	--	2	2129	0	--
17. SO. FL. - BAHAMAS (3)								
NAS (Key West)	16	9072	7	4320	8	7696	11	1227
NUSC (Bahamas)	0	--	6	920	1	210	1	966
Surf Wpns Ctr Det (Ft. Lauderdale)	0	--	1	140	4	1460	3	360
TOTALS	372	372,218	243	166,636	244	672,196	183	58,771

Figure 3.4-2

FACILITIES IN SPECIALIZED U/W INSPECTION PROGRAM

FACILITY	NO. OF FACILITIES	FACILITIES LENGTH	REPLACEMENT COST
PIERS	419	407,867FB (77 MI.)	$2.164 BILLION
WHARFS	265	169,758FB (32 MI.)	$1.223 BILLION
SEAWALLS, BULKHEADS, & QUAYWALLS	315	743,803LF (141 MI.)	$923 MILLION
SMALL CRAFT BERTHING	221	64,811FB (12 MI.)	$190 MILLION
TOTALS	1,220		$4.5 BILLION

Figure 3.4–3

DISTRIBUTION OF PIERS IN KEY GEOGRAPHIC AREAS

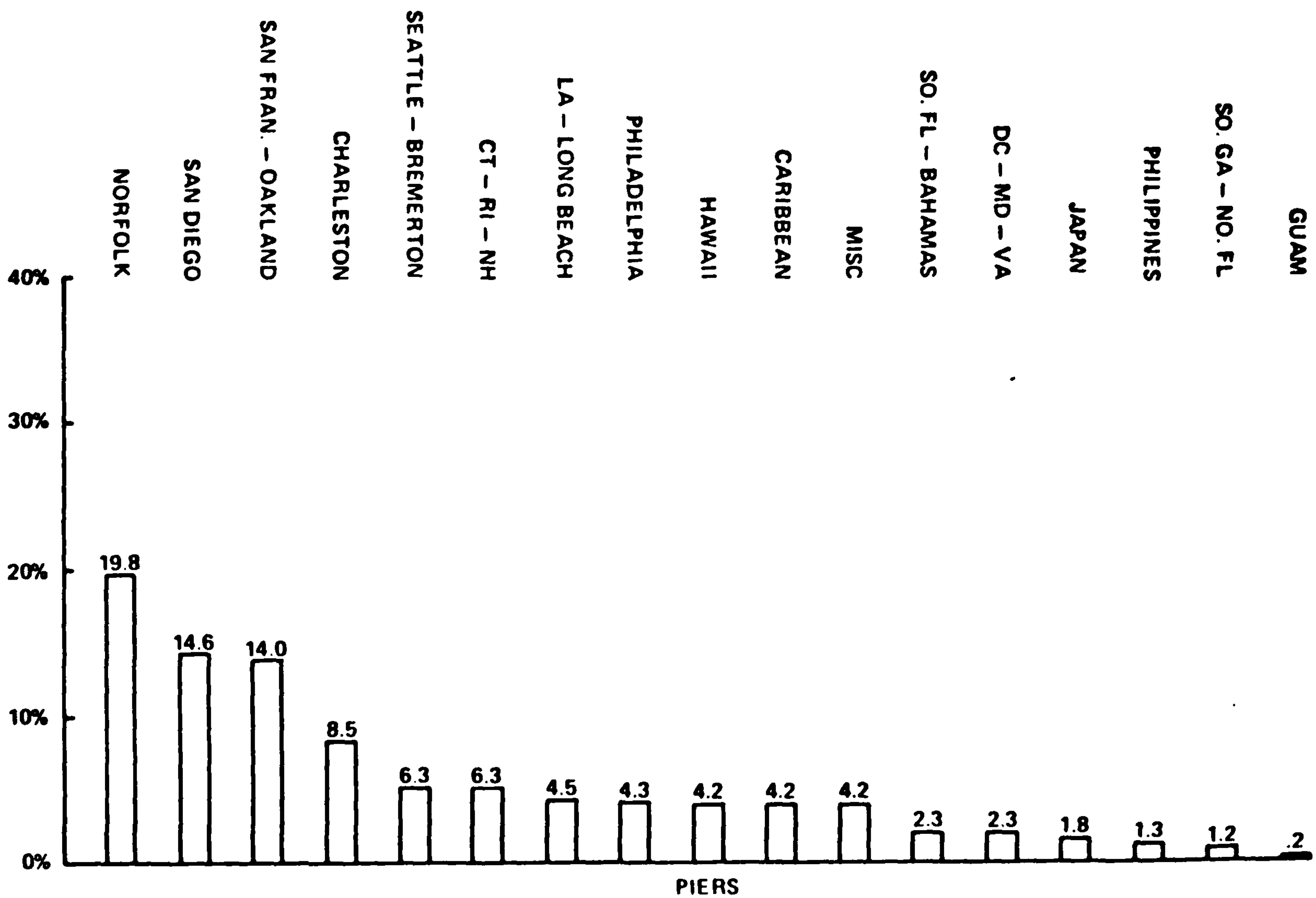


Figure 3.4–4
DISTRIBUTION OF WHARFS IN KEY GEOGRAPHIC AREAS

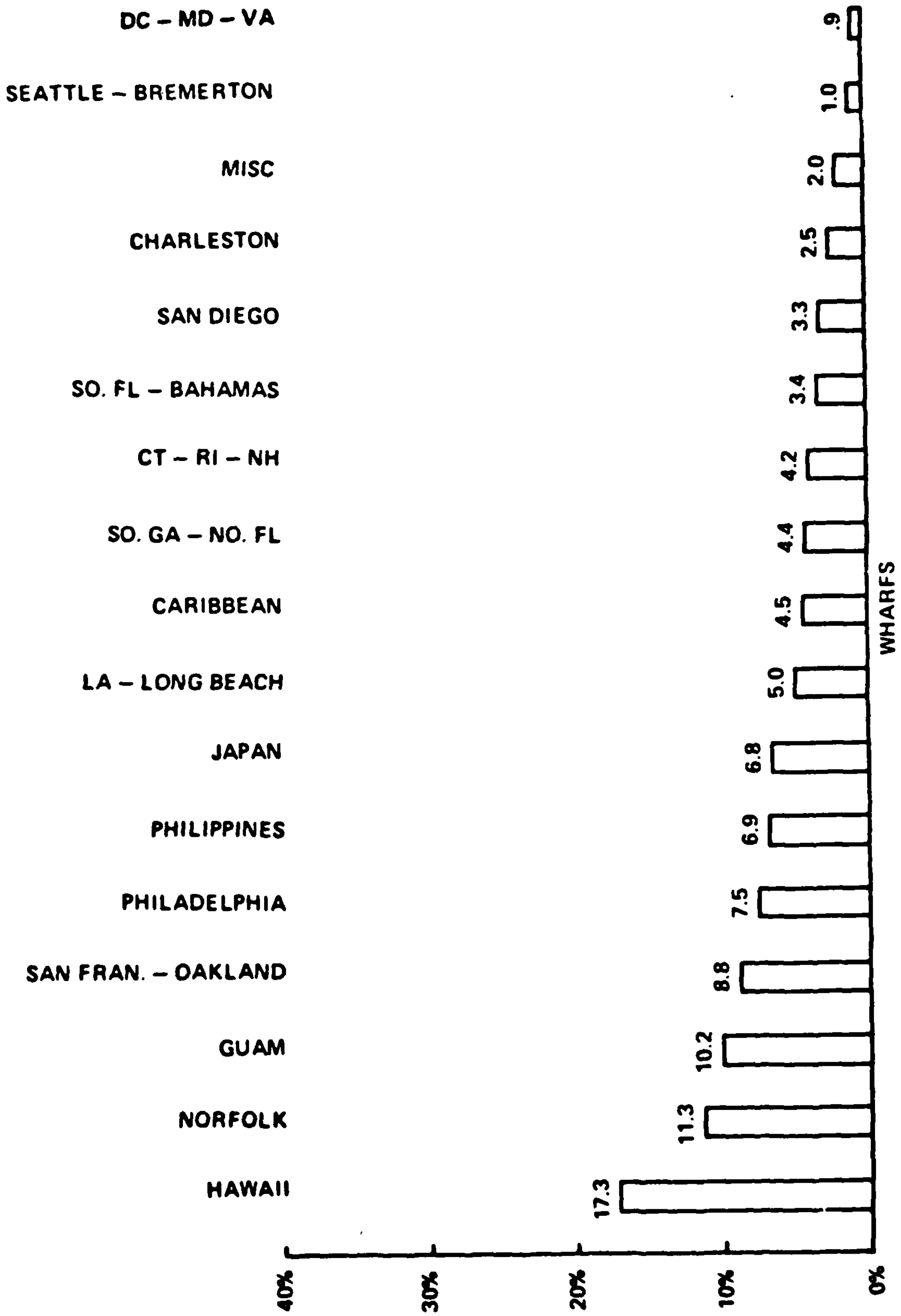


Figure 3.4-5

DISTRIBUTION OF QUAY WALLS, SEA WALLS, AND BULKHEADS IN KEY GEOGRAPHIC AREAS

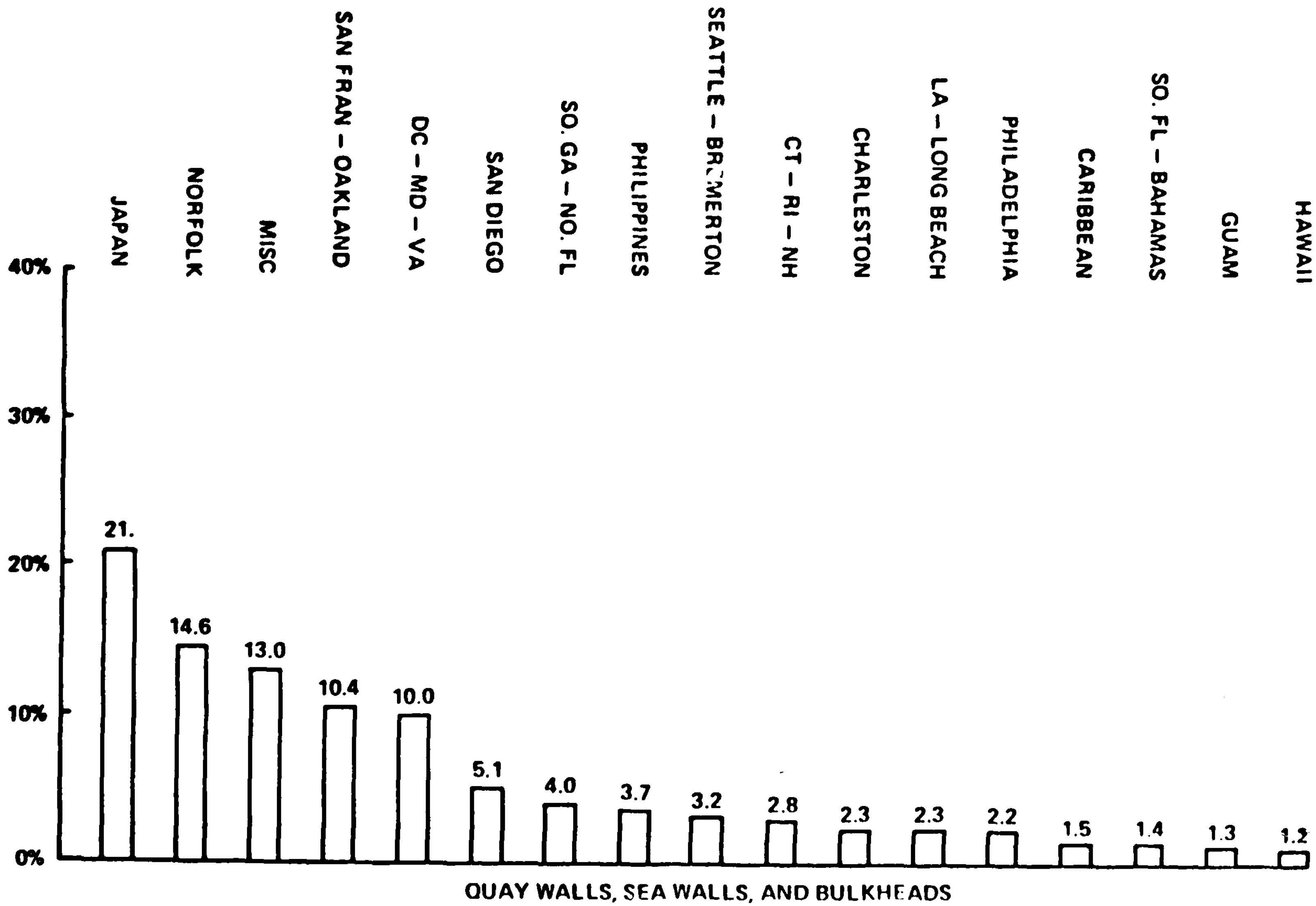


Figure 3.4-6

DISTRIBUTION OF SMALL CRAFT BERTHING IN KEY GEOGRAPHIC LOCATIONS

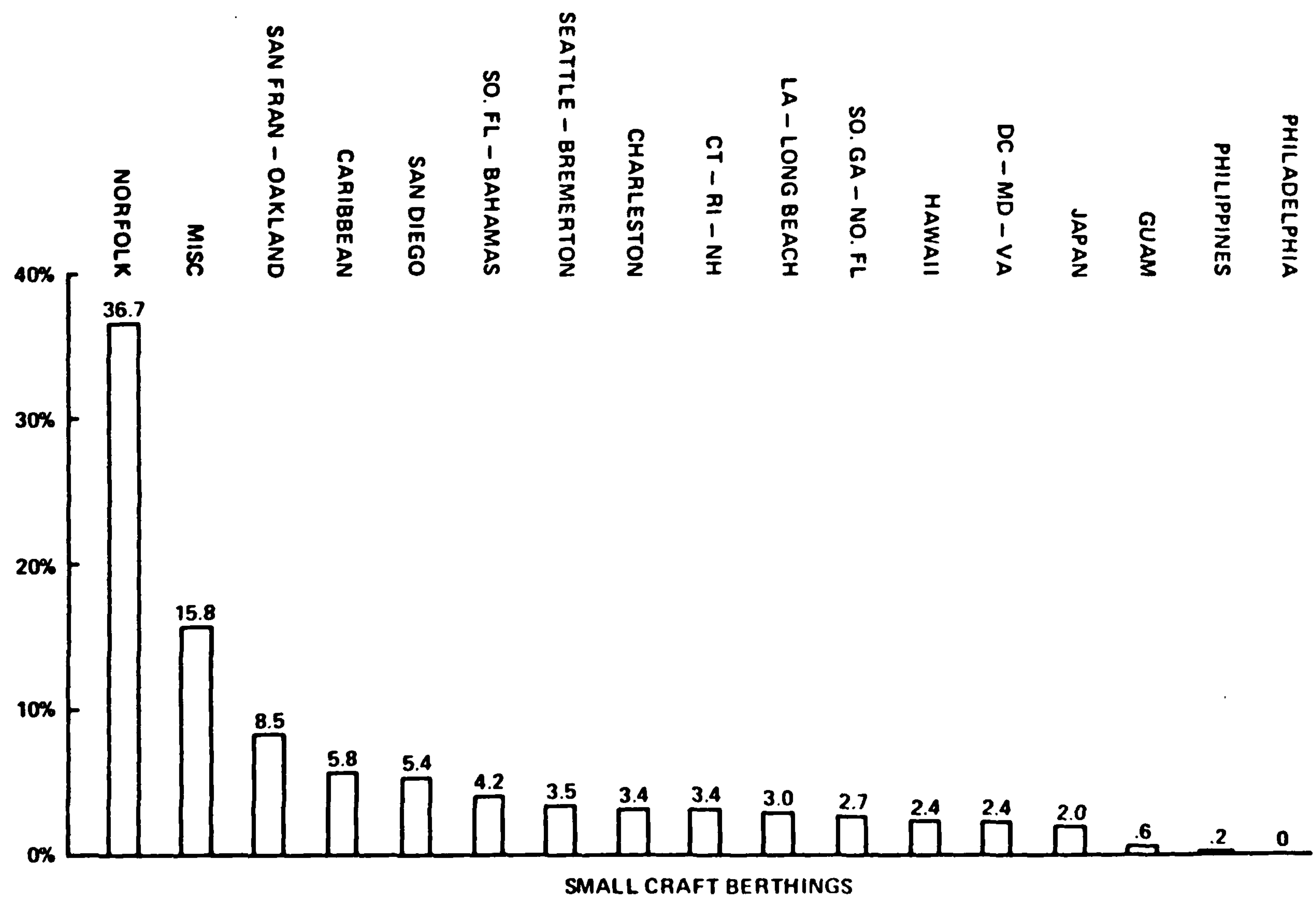
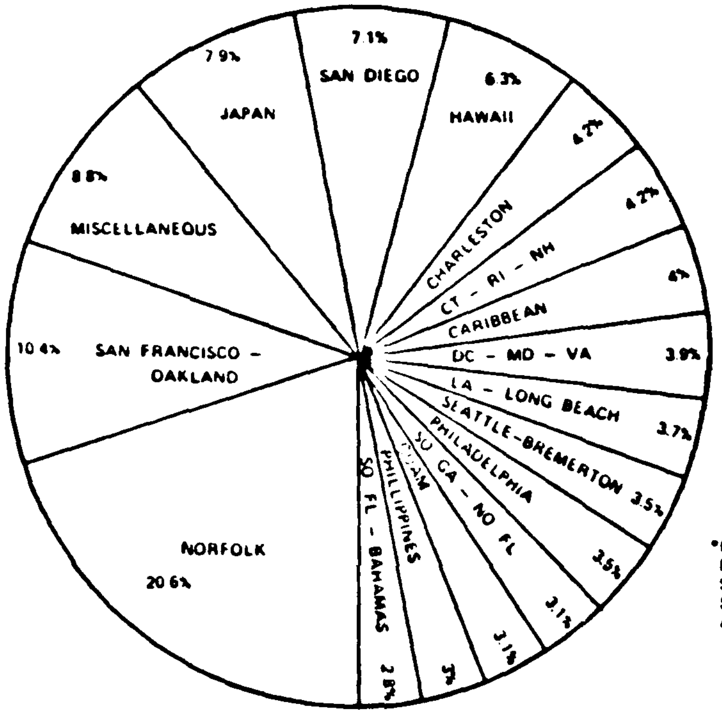


Figure 3.4-7

PERCENTAGE OF FLEETWIDE WATERFRONT STRUCTURES* AT ALL NAVY ACTIVITIES



*INCLUDES ONLY PIERS, WHARVES, SM. CRAFT BERTH., SEA/QUAY WALLS AND BULKHEADS

Figure 3.4-8

DISTRIBUTION OF NAVY'S MAJOR U/W STRUCTURES BASED ON NUMBER OF FACILITIES

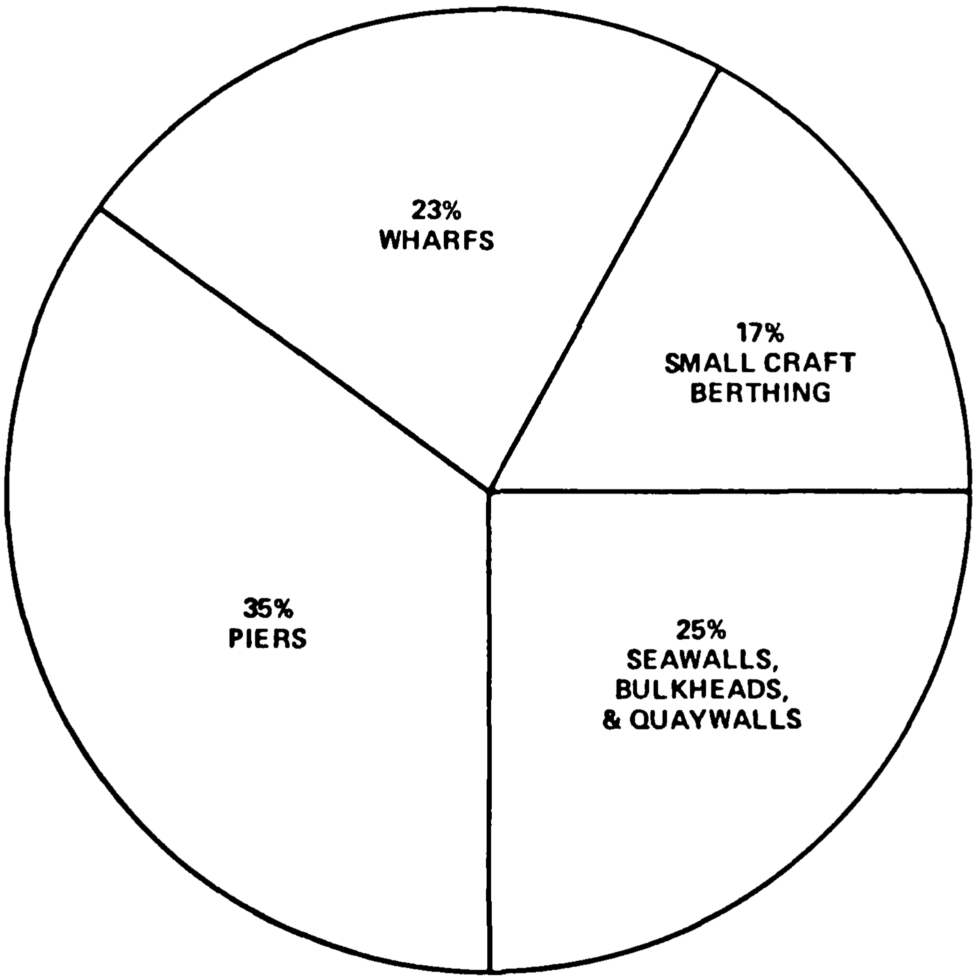
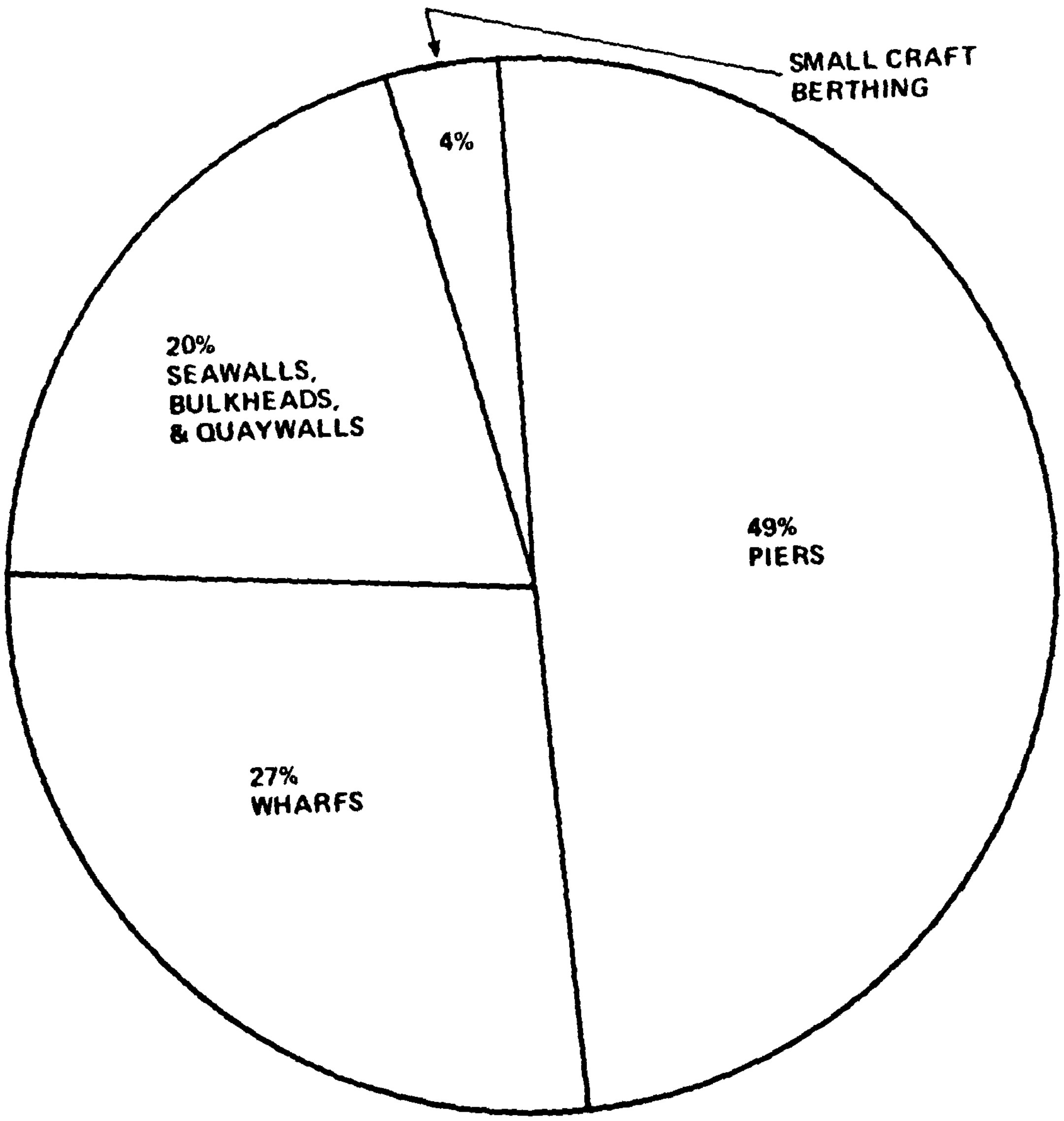


Figure 3.4-9

DISTRIBUTION OF NAVY'S MAJOR U/W STRUCTURES

BASED ON REPLACEMENT COST



4. UNDERWATER INSPECTIONS AND ASSESSMENTS

The U/W inspections in this program have been planned to provide the activities PWOs with quantified structural assessments of their major UKWFs sufficient to plan realistic M&R. These assessments should provide substantiation for the PWOs requests from their major claimants for special project funding for the next fiscal year. The intended result is more accuracy in the backlog of M&R which has been steadily increasing in recent years. This should occur as long as the quality of the inspections and assessments is maintained at a high level of expertise. This inspection and assessment expertise is essential for the U/W Inspection Program to maintain a fine balance between surveying many facilities with minimal funds and providing structural evaluations and M&R guidance adequate for realistic PW planning. Further details on performance standards required to achieve this are provided in Section 6.

Frequently the numbers of piles found in a pier during inspections differs from those shown in the latest available drawings. These differences have ranged from two extra on the Explosive Handling Wharf at the Trident Refit Facility, Bangor, to about 50 extra on the Marginal Wharf at the SUBBASE, Bangor. In one extreme case, the inspection of the piers at the NAVWPNSTA, Earle, N. J. were inspected without CHESDIV having received sufficient drawings for a pile count but with a UFQ from the PWO indicating a total pile count of 6,680. At the time of inspection a count of the piles revealed over 30,000 piles.

The U/W inspections performed in FY 80 and FY 81 are described in Figures 4-1, 4-2, and 4-3. In the first year, six of the facilities inspected were judged to require immediate attention. Four mooring platforms were inspected by UCT-1 under CHESDIV guidance at the Naval Fuel Depot, Jacksonville, FL; the CHESDIV report recommended that they no longer be used and should be replaced. Before the inspection report was delivered, one of the mooring platforms collapsed. Fortunately, only one person was on the structure at the time and he managed to jump onto the side of a tug at the critical moment. The inspection had been much too late to salvage these structures for their intended use.

It was recommended that the line load capability of Pier 17 at the Submarine Base, New London be downrated to 36% of design value. During the

Figure 4-1a

UNDERWATER INSPECTIONS PERFORMED IN FY 80

NORTHEAST

SUBMARINE BASE, NEW LONDON:	QUAY WALLS – BULKHEADS (7) PIERS – NOS. 2,6,10, 12,13,15,8,17 (5) MOORING PLATFORMS AT STATE PIER

CARIBBEAN

NAVAL STATION, GTMO, CUBA:	(6) PIERS – A, C, D, L, Q, V QUAY WALLS (2) WHARFS – B, T MOORING BB – 1

SOUTHEAST

NAVAL STATION, MAYPORT:	NORTH BULKHEAD C – 1 AND C – 2 WHARVES BRAVO AND DELTA WHARVES
NAVAL AIR STATION, JAX:	FUELING PIER SUPPLY PIER (5) DWEST PIERS (9) LANDING LT. STRUCTURES BULKHEADS
NAVAL FUEL DEPOT, JAX:	(4) MOORING PLATFORMS

Figure 4-1b

UNDERWATER INSPECTIONS PERFORMED IN FY 80 (CONT'D)

SOUTHEAST

NAVAL AIR STATION, KEY WEST:	(2) PIERS – D1 & D3 QUAY WALL (3) FINGER PIERS – 1,2, &3
NAVAL WEAPONS STATION, YORKTOWN:	AMMO PIER R3

WEST

NAVAL SUPPLY CENTER, SAN DIEGO:	FUEL PIER 180
NAVAL AIR STATION N. ISL. SAN DIEGO:	J/K PIER QUAY WALL

PACIFIC AREA

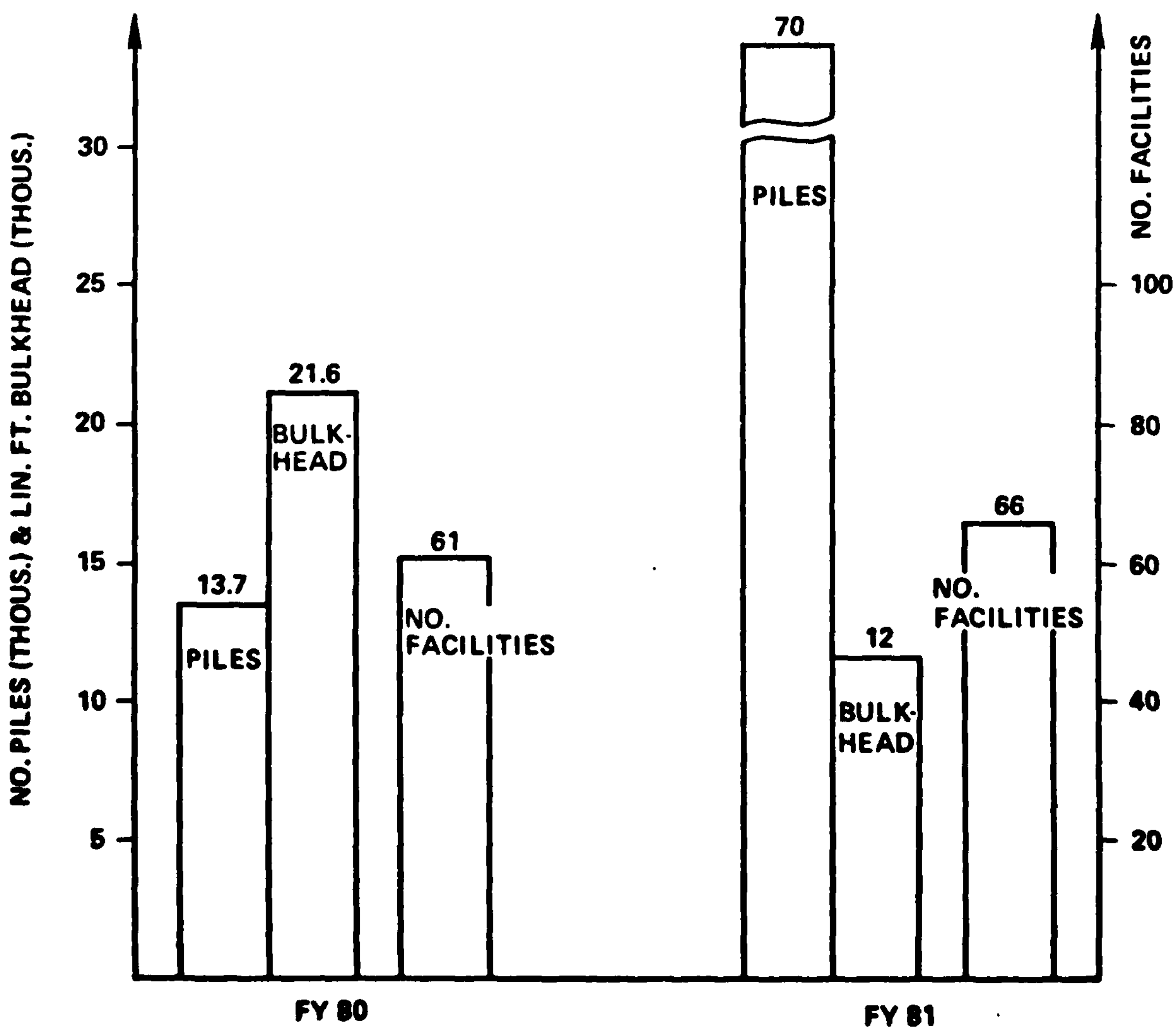
NAVAL STATION, ADAK:	(5) PIERS BULKHEAD
NAVAL STATION, SUBIC BAY:	LEYTE CARRIER WHARF
NAVAL MAGAZINE, SUBIC BAY:	CAMAYAN AMMO WHARF NABASAN AMMO WHARF

Figure 4-2

UNDERWATER INSPECTIONS PERFORMED IN FY 81

NORTHEAST	
NAVAL WEAPONS STATION, EARLE, N. J.:	(3) PIERS – NOS. 1,2,&3 (2) TRESTLES – NOS. 1&2
NAVAL STATION, NEWPORT, R.I.:	PIER 2 APRON WHARF
SOUTHEAST	
NAVAL WEAPONS STATION, CHARLESTON:	WHARF A (2) PIERS – B&C
NAVAL STATION, CHARLESTON:	(10) PIERS – K,L,M,N,P,Q,R,S,T,U
NAVAL SHIPYARD, CHARLESTON:	(3) PIERS – D,H, &J QUAYWALL
NAVAL SHIPYARD, NORFOLK:	(4) PIERS – 3,4,5,6 (2) QUAYWALLS
NAVAL STATION, NORFOLK:	DEPERMING PIER (5) OTHER PIERS – NOS. 5,7,12,20,21 BULKHEAD
NORTHWEST	
SUB BASE, BANGOR, WA:	MARGINAL WHARF
TRIDENT REFIT FACILITY, BANGOR, WA:	DEPERMING PIER
TRIDENT REFIT FACILITY, BANGOR WA:	DELTA PIER TRESTLE REFIT PIER NO. 1 REFIT PIER NO. 2
STRATEGIC WEAPONS FACILITY PACIFIC, BANGOR, WA:	EXPLOSIVE HANDLING WHARF NO. 1
NAVAL SUPPLY CENTER, MANCHESTER, WA:	FUEL PIER
NAVAL SHIPYARD, BREMERTON:	(2) QUAYWALLS (4) MOORING PLATFORMS (10) PIERS
WEST	
NAVAL AIR STATION, NORTH ISLAND, SAN DIEGO:	J/K PIER

Figure 4-3
UNDERWATER INSPECTION RESULTS



inspection of the structural piles of Pier 17 an unusual condition was noted. Most of the structural piles had a splice along their exposed length and several piles had two (2) splices. Due to the heavy marine growth and bio-fouling, and the presence of thick layers of corrosion by-products, the task of actually finding the splices was extremely difficult. During the initial swim-by of many of the piles, no splices were observed. Since there was no record of the splices in any of the Government furnished information, which included as-built drawings, the divers were unaware of their existance. The first splice was revealed when the divers were cleaning the piles down to bare metal so that ultra-sonic thickness measurements could be obtained. Once this first splice was noted, the divers returned to many of the previously inspected piles and, by cleaning large areas of the piles, found many additional splices. Based on the number of piles found to have splices during the period that the divers were actually looking for the splices, it was projected that 66% of the bearing piles had splices and that 7% of these had two splices, many of them deteriorated by corrosion. Pier 17 is currently scheduled for repairs in FY 82 with $300,000 in funds provided.

At the Naval Station, Guantanamo Bay, a CHESDIV and UCT-1 U/W inspection and structural assessment of Pier Lima resulted in a recommendation to have its vertical live load capability downrated to 50% of design value and its lateral load capability downrated to 38% of design value. Recommendations were made to repair many piles of short jacket concrete encasement and the cost for this work to be performed by a commercial contractor was estimated at a budgetary level of $1.3M. Underwater Construction Team One (UCT-1) has since taken on these repairs and expects to complete them in another year within the present budget of $434K. These repairs should provide an additional pier life of 12-15 years.

In FY 81, U/W inspections of four facilities revealed need for immediate attention. Data for the fuel pier at the Naval Supply Center, Manchester, WA, Piers H&J at the Naval Shipyard, Charleston and Pier Bravo at the Naval Weapons Station, Charleston are presently being analyzed as part of the inspection reports due for completion soon. As with previous reports, any significant downrating of facility load capability considered necessary will be estimated along with budgetary repair cost and recommended types of repairs.

While these estimates and recommendations are general in nature they

should serve more use than typical report recommendations which call for extensive and more detailed additional inspections. Although such additional inspections may be recommended in the CHESDIV reports, the program management is determined to obtain the maximum direct M&R guidance possible from these initial, limited baseline inspections by utilizing the most highly qualified personnel available. This special expertise is expected to enable CHESDIV to project from small data samplings the desired evaluations of facilities conditions, and M&R needs and costs.

In the schedules of Figures 4-4a through 4-4d the activities and their facilities which have been U/W inspected since the start of the program are indicated in approximate chronological order of occurence. Projections are also included for inspections scheduled in the coming year. The number of inspections projected for FY 82 is more than can be supported by the budget planned for FY 82. However, the total number falls far short of what would be required per year if all of the Navy's priority facilities were to be inspected within a time period necessary to assure proper M&R and operational life. This subject is explored further in Section 5.

Figure 4-4a

U/W INSPECTION SCHEDULE

FOR BASELINE SURVEY OF NAVY U/W STRUCTURES

U W INSPECTION SITES	1979							1980											
	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NAVSTA, GTMO, CUBA (6) PIERS, QUAYWALLS, MOORINGS	■																		
NAS, KEY WEST (5) PIERS, QUAYWALL								■											
NAS, JACKSONVILLE, FL (7) PIERS, BULKHEADS NFD, JACKSONVILLE, FL (4) MOORINGS										■									
SUB BASE, NEW LONDON, CT (7) PIERS, (5) MOORINGS, BULKHEADS											■	■							
NAVSTA, ADAK, ALASKA (5) PIERS, BULKHEADS														■					
NAVSTA, MAYPORT, FL (10) WHARFS, BULKHEAD														■					
NAVSTA, SUBIC BAY, P.I. NAVMAG, SUBIC BAY, P.I. (3) WHARFS															■	■			
NAVWPNSTA, YORKTOWN, VA AMMO PIER																■			
NAVSUPCEN, SAN DIEGO NAS N.I., SAN DIEGO FUEL PIER, J/K PIER, QUAYWALL																■			

Figure 4-4b

U/W INSPECTION SCHEDULE

FOR BASELINE SURVEY OF NAVY U/W STRUCTURES

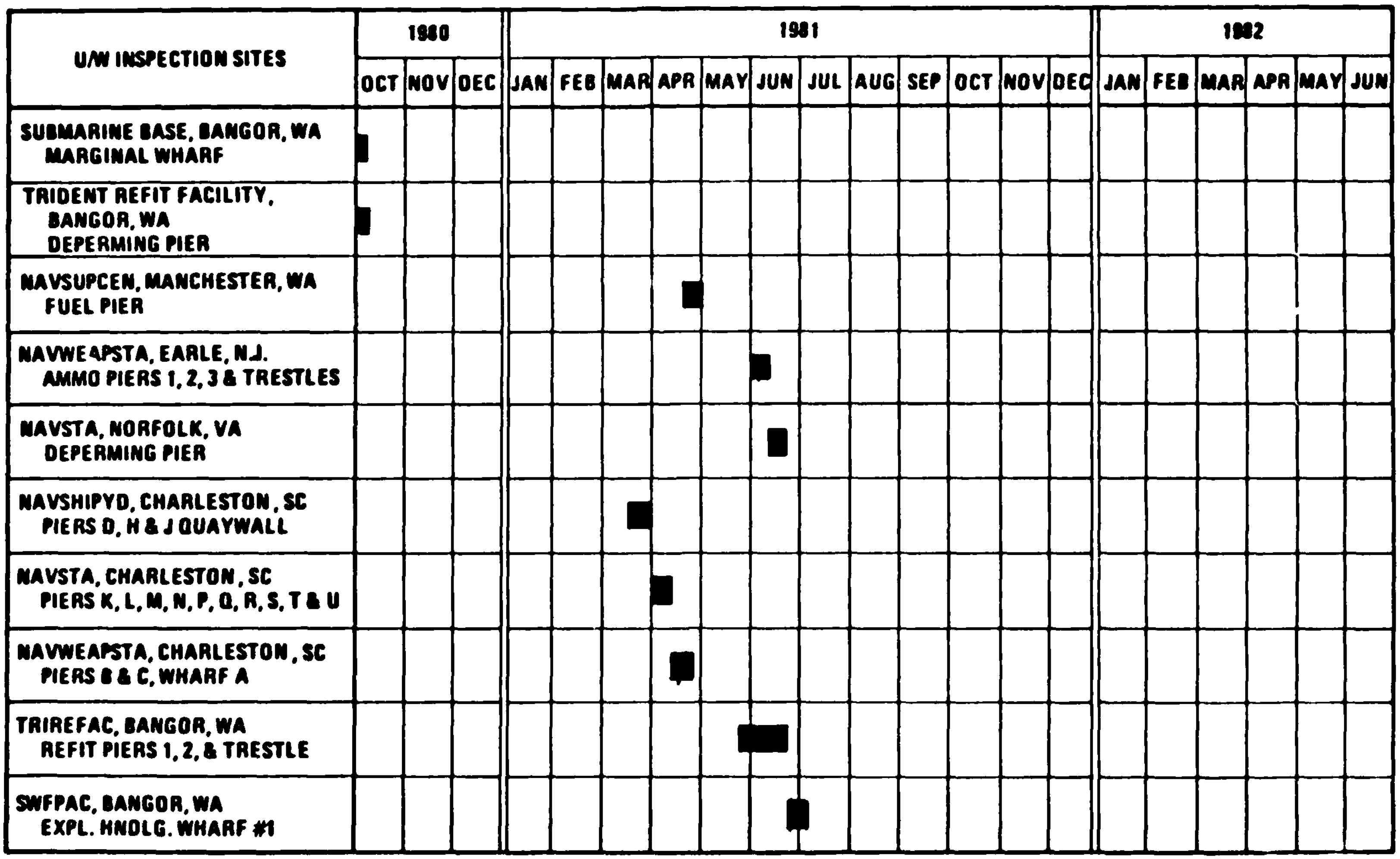


Figure 4-4c

U/W INSPECTION SCHEDULE FOR BASELINE SURVEY OF NAVY U/W STRUCTURES (CONT'D)

U/W INSPECTION SITES	1981												1982					
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
NAVAIRSTA, NI, SAN DIEGO, CA PIER J/K						■												
NAVSTA, SAN DIEGO, CA PIERS 1, 3, 4, 5, 6 & 8											■							
NAVSHIPYD, PORTSMOUTH, VA QUAYWALLS, PIERS 3, 4, 5, 6, BERTHS 3, 6							■											
SUBBASE, SAN DIEGO, CA (3) PIERS, BULKHEAD															■			
NAVSUPCEN, SAN DIEGO, CA PIER 11A																		■
NAVSUPCEN, OAKLAND, CA (3) PIERS, (3) WHARVES														■				
NAVSTA, NEWPORT, R.I. PIER 2					■													
NAVSHIPYD, BREMERTON, WA (2) QUAYWALLS, (10) PIERS (4) MOORING PLATFORM									■									
NAVSTA, ROOSEVELT ROADS (4) PIERS, (4) SMALL CRAFT BERTHING, (3) WHARVES														■				

Figure 4.4-d

U/W INSPECTION SCHEDULE

FOR BASELINE SURVEY OF NAVY U/W STRUCTURES

(CONT'D)

U/W INSPECTION SITES	1981												1982							
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
NAVSTA, NORFOLK, VA (7) PIERS									■											
NAVSUPCEN, SAN DIEGO, CA FUEL PIER														■						
NAVSTA, ADAK, AL (4) PIERS																			■	
NAVSUPPACT, MARE ISLAND, VALLEJO, CA (2) PIERS																			■	
MARE ISLAND NAVSHIPYD, VALLEJO, CA QUAYWALLS, (7) PIERS																				■
NAVAIRSTA, ALAMEDA, CA BULKHEAD, (4) PIERS																				■
NAVSTA, NORFOLK, VA. (9) PIERS, (2) BULKHEADS																■				

5. PROGRAM PLANNING

Planning for the U/W Inspection Program has had to be flexible. Before NAVFAC funding for the program was available in October 1979, a search for facilities data had been made. The data required to plan the program was not available and the scope of the effort required to obtain this data became evident. It was accepted from the start of FY 80 that a considerable amount of labor and time would be expended on data acquisition and analysis before a meaningful program plan could be established. Therefore, when the program officially began with FY 80 funds, it was paralleled by an effort (unfunded) to obtain the required facilities data. For eight months of FY 80, during which time U/W inspections had been planned and performed, enough facilities data had been obtained to develop several options for a long range program plan.

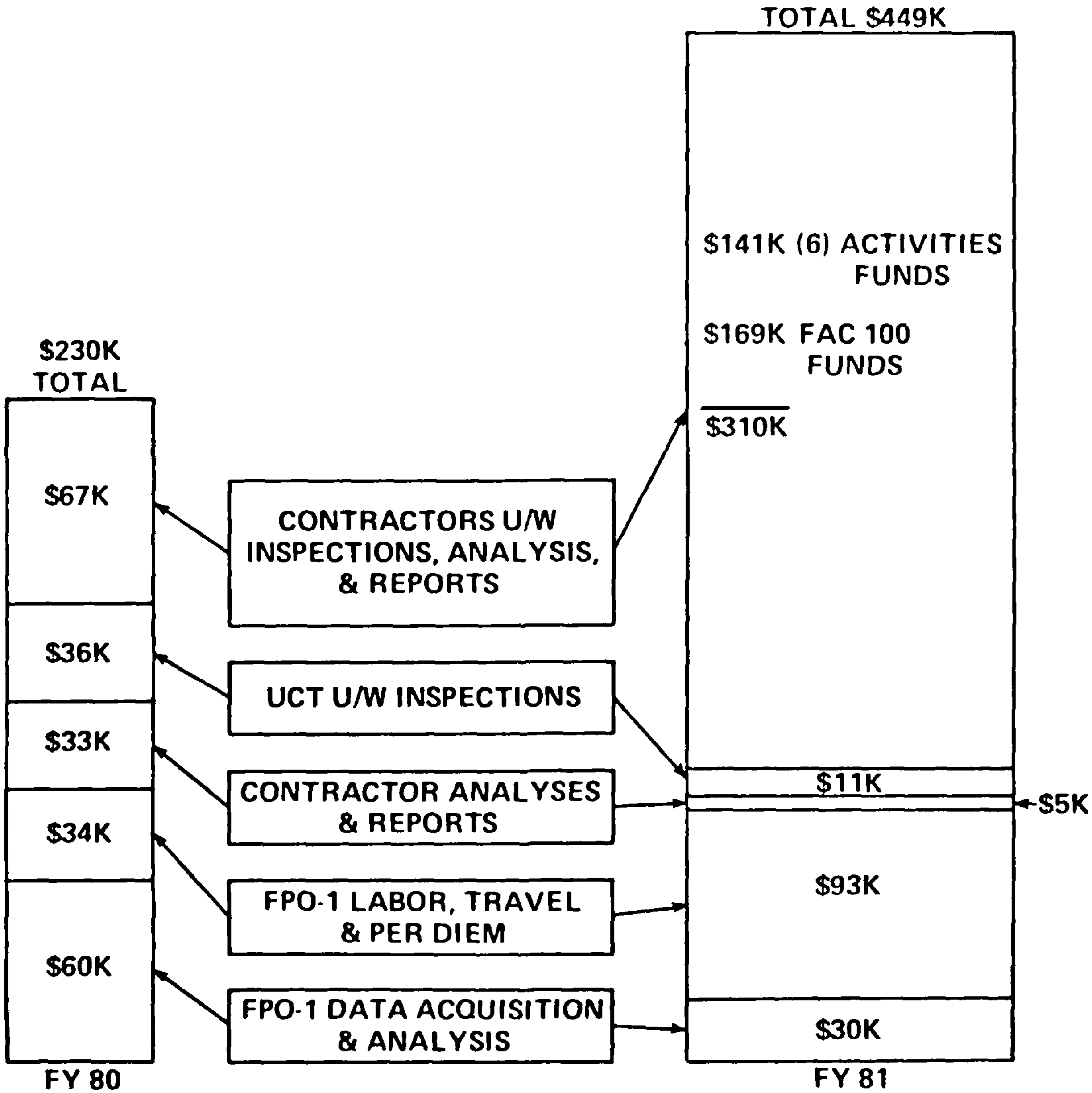
The option which NAVFACENGCOM Code 100 preferred proposed a seven year inspection cycle in which all of the Navy's priority UWWFs would be U/W inspected in the manner described in Section 4. The yearly cost at that time was estimated to be $468,000 exclusive of related tasks such as the establishment of a computerized facilities data inventory which are also critically needed.

In the first year, FY 80, a budget of $230,000 was funded for the program of which 26% ($60K) was used to acquire and analyze facilities data as described in Section 3. The funds provided by NAVFACENGCOM Code 100 to CHESDIV in FY 81 were $306,000 of which 10% ($30K) were used on facilities data. Figure 5-1 indicates that additional funds provided by activities desirous of early program assistance raised the FY 81 budget to a total of $442,000. Considerable labor was applied to all phases of the program by intermittent work of several engineers (PDCs) in the Professional Development Center Program which effectively served as a subsidy of the program by CHESDIV. These occurred in the areas of facilities data acquisition and analysis and development of standards and guidelines. Most of this work was done on a "when available" basis by PDCs (as part of their training in the NAVFAC mission management funded PDC program) and is not reflected in Figure 5-1.

The necessity for planning flexibility, referred to earlier, resulted from unpredictable activity funds obtained to augment the limited program

Figure 5-1

U/W INSPECTION PROGRAM EXPENDITURES



funding available. FPO-1 labor included directing PDC data acquisition effort, planning inspections, working on contracting procedures, monitoring inspections, and reviewing and editing reports and structural analyses.

The inspections planned for FY 82, as listed in Figure 5-2, probably will require more funding than NAVFACENGCOM Code 100 has budgeted. Since the inspection planning and contracting procedures are time consuming, and must be planned in advance, CHESDIV will continue to solicit activity funding to supplement normal program funds. Long range planning will continue to change markedly because of this underfunding.

In the first two years, baseline inspection funding has amounted to roughly half of that initially estimated as necessary for a seven year inspection cycle. Over the same period the costs of U/W inspections have increased substantially thereby widening the gap between long range objectives and long range prospects.

Late in FY 80, a seven year inspection cycle was proposed which would require an annual expenditure of $468,000. The bar graph of Figure 5-3 illustrates the annual inspection goal of 150 facilities set by this plan for post-FY 81. Now, after two years of less funding than requested, a seven year cycle annual goal would be 162 facilities per year (Figure 5-4). Considering the practical limitations of contracting procedures, it is logical to aim at more realistic targets. Figure 5-5 illustrates a ten year inspection cycle goal requiring the inspection of 101 facilities annually. Based on experience to date this is achievable with the CHESDIV manpower presently available using the number of contractors presently under contract.

It is possible that breakthroughs on inspection equipment or techniques presently under development could improve inspection efficiency sufficiently to reduce materially the annual costs. Such developmental work is constantly being reviewed. If or when such advances appear to warrant it, CHESDIV will update these estimates of annual costs.

If lesser amounts have to be accepted for regular yearly budgets it will be necessary to use different inspection cycle periods for facilities according to their priority ratings. These priorities would be based on mission use, structure material, age, extent of use, M&R record, etc. CHESDIV now

Figure 5-2

UNDERWATER INSPECTIONS PLANNED FOR FY 82

WEST

NAVAL SUPPLY CENTER, OAKLAND:	FUEL PIER BULKHEAD
NAVAL STATION, SAN DIEGO:	PIER NOS. 1,3,4,5,6,8
NAVAL SUPPLY CENTER, PT. LOMA:	FUEL PIER #180
SUBMARINE SUPPORT FACILITY:	(3) PIERS – 5000,5002,5003
NAVAL SUPPLY CENTER, SAN DIEGO:	SUPPLY PIER #11A
NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO:	PIER 160
MARE ISLAND NAVAL SHIPYARD, VALLEJO, CA:	QUAYWALLS (7) PIERS
NAVAL SUPPORT ACTIVITY, MARE ISLAND, VALLEJO, CA:	(2) PIERS
NAVAL AIR STATION, ALAMEDA, CA:	(4) PIERS BULKHEAD
NAVWPNSTA, CONCORD, CA:	(3) PIERS
NAVAL STATION, ADAK:	(4) PIERS
NAVAL STATION, ROOSEVELT ROADS:	(4) PIERS (4) SMALL CRAFT BERTHING (3) WHARVES

Figure 5-3

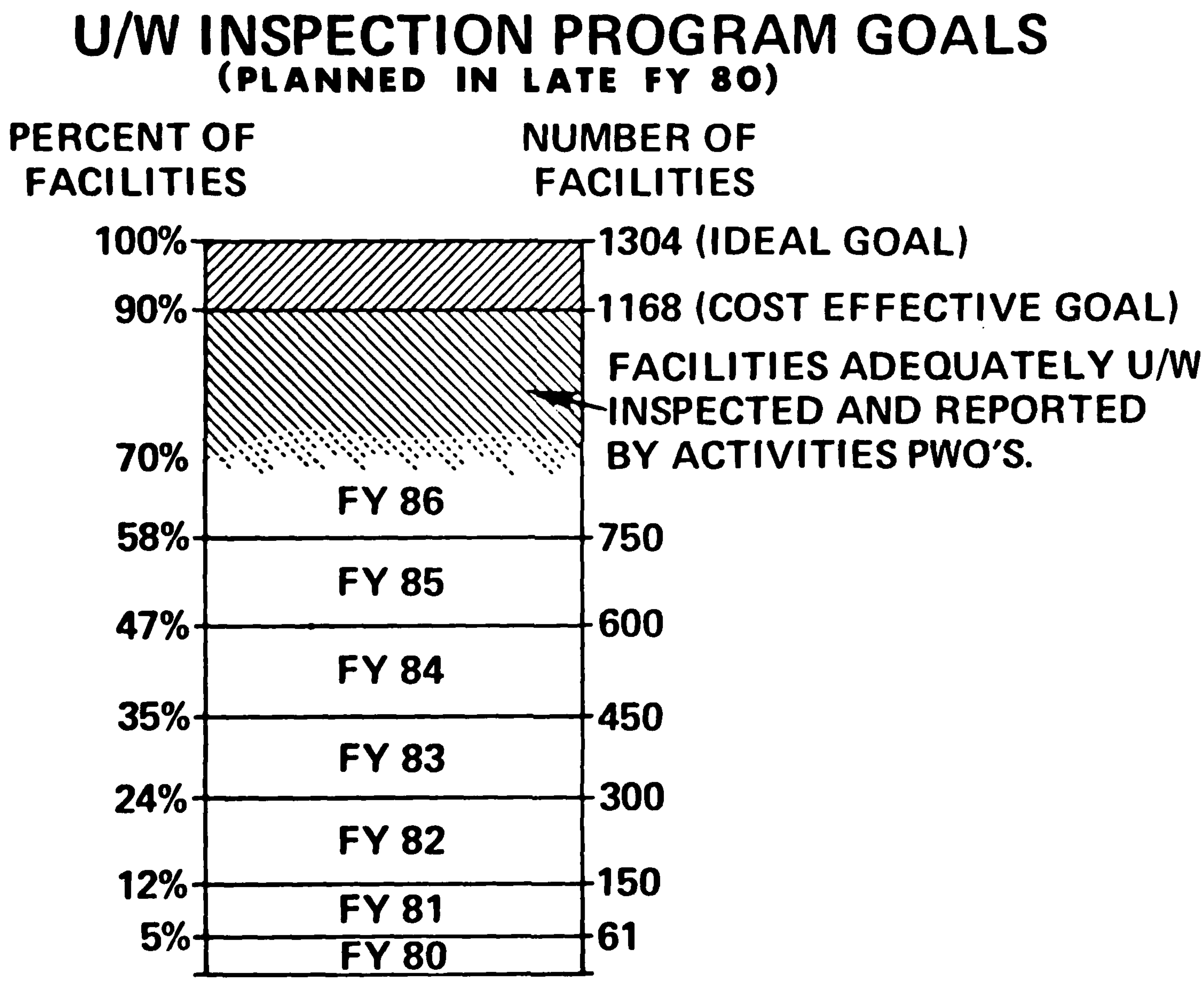

U/W INSPECTION PROGRAM GOALS
(PLANNED IN LATE FY 80)
PERCENT OF FACILITIES
NUMBER OF FACILITIES
100%
90%
70%
58%
47%
35%
24%
12%
5%
1304 (IDEAL GOAL)
1168 (COST EFFECTIVE GOAL)
FACILITIES ADEQUATELY U/W INSPECTED AND REPORTED BY ACTIVITIES PWO'S.
750
600
450
300
150
61
FY 86
FY 85
FY 84
FY 83
FY 82
FY 81
FY 80

Figure 5-4

U/W INSPECTION PROGRAM GOALS

(7 YEAR CYCLE PLANNED 11/81)

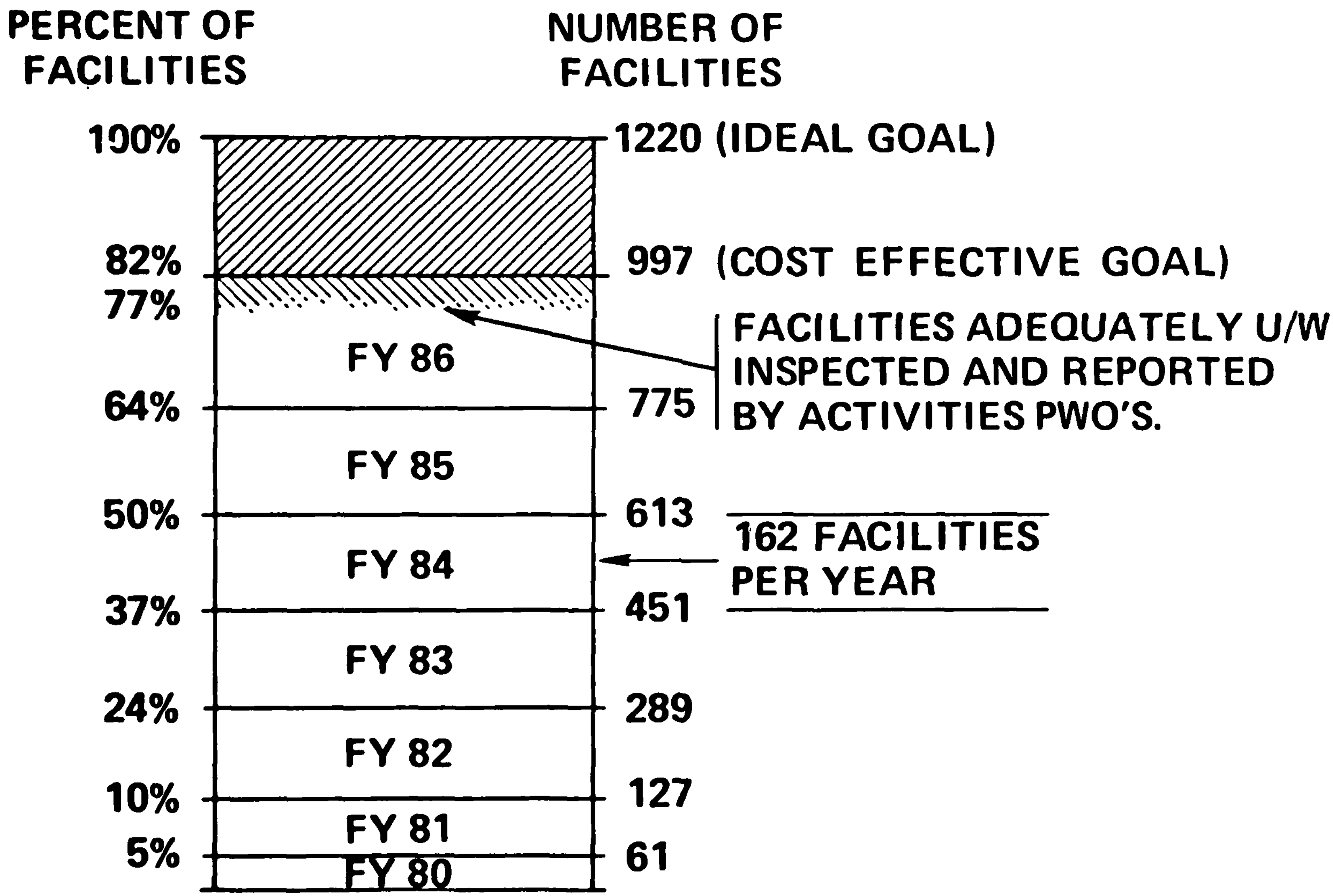


Figure 5-5

U/W INSPECTION PROGRAM GOALS
(10 YEAR CYCLE PLANNED 11/81)

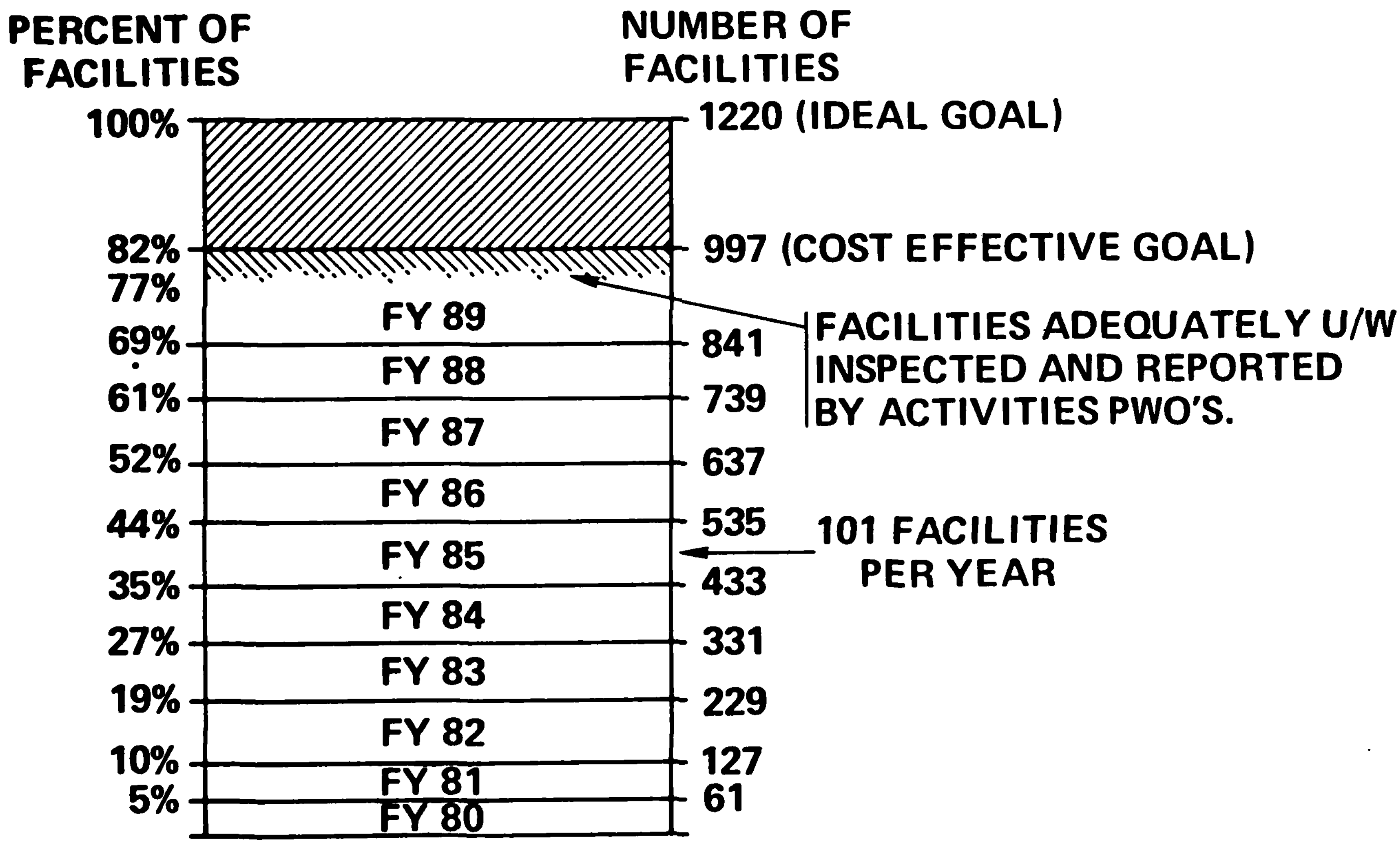


Figure 5-6

U/W INSPECTION PROGRAM TIME/COSTS COMPARISONS

	FAC/YR	COST($K)	YRS/CYCLE
FY 80 (ACTUAL)	61	230	20
FY 81 (ACTUAL)	66	442 (INCLUDES 136K FROM ACTIVITIES)	18
FY 82 (EST. FOR ORIG. PROG. GOAL)	150	1550	8
FY 82 CMP	175	1840	7
MODIFIED TARGET (FY82 $)	101	1049	10
FY 82 (Budget)	47	280	24

Based on 1220 facilities at 256 activities.

has enough experience and data to perform this task. However, it is still necessary to inspect all UWWF's initially to establish a baseline, after which they can be categorized for different inspection cycle periods.

The nature of the long range plan which is established will be chiefly dependent upon the level of funding assumed to be available. It is helpful to compare the rates and costs of U/W inspections against the time required per inspection cycle. Figure 5-6 indicates that at the rate of funding and at the rate of inspections which took place in FY-80 and FY-81 the time which would be required to inspect the targeted 1220 UWWF's would be on the order of 20 years and 18 years respectively. An early program goal of 150 inspections per year would now cost about $1.5M per year in an updated 8 year cycle (Figure 5-6). The FY-82 Command Management Plan goal of 175 inspections per year in a 7 year cycle would require a yearly budget of $1.8M.

Attempts to compare the data in different parts of Figure 5-6 can be very misleading since they are the product of many factors with non-linear relationships. These factors include facilities differing greatly in size, number of piles, water depths, etc., inflation, carryover of inspection tasks from one year to another, rapid fall-off in cost efficiency as number of facilities per year decreases, etc.

The FY-82 target of 101 facilities per year listed in Figure 5-6 is CHESDIV's estimate of a realistic goal based on present limitations of contracting procedures and CHESDIV manpower. The last comparision in Figure 5-6 is based on the latest projection of the FY-82 program budget being $280K and not assuming any additional funding available from activities. Also, other negative and positive influences are taken into account. These include FY-81 CHESDIV money available at UCT-1 and CINCPACFLT funds at UCT-2 for FY-82 U/W inspections. They also include tasks to write part of MO-322 Volume 4 on U/W inspection requirements and the development of a computerized UWWF data inventory. The net effect is a CHESDIV estimate at this time of 47 facilities inspected in FY-82 and, if this level of funding were repeated yearly, a period of 24 years required to complete all U/W inspections.

6. STANDARDS FOR PROCEDURES, TECHNIQUES, EQUIPMENT, AND DATA

The extensive offshore oil drilling in the North Sea has brought about the creation of a number of U/W inspection standards for offshore structures by government and private agencies in several countries. In considering the applicability of these standards to NAVFAC's UWWFs it is important to be aware of the significant differences in the basic nature of the diving environments of offshore and waterfront structures. Also, one must recognize the differences between the objectives of the baseline inspections of the Specialized Inspection Program and the necessarily detailed (NDT) inspection of offshore structures. The driving consideration of the former is the general condition assessment of very many structures in a relatively short time period at a very low cost. The limited government funding is a political reality which NAVFAC must live with.

In the latter situation, oil companies expend huge funds per inspection of oil rig structures where enormous financial risks and earnings are at stake. The funds available per inspection are considerably larger dictating the use of more and different inspection options.

In baseline inspections, unlike detailed ones, maximum speed and minimum cost dictate using mostly visual inspections (swim-by) of structures "as is" with only a small percentage of structure members in critical areas spot checked with cleaning and NDT measurements. Therefore, most of any structure evaluation is based on diver in-situ judgement, a very small percentage is based on later analysis of NDT measurement data. The subjective judgement of the diver is very important because of the large amount of each inspection which is purely visual. The more expert this diver (structural engineer, PE) is, the more useful will be the visual evaluation and the higher the confidence can be in his M&R recommendations. The environmental conditions of UWWFs are less adverse than offshore structures - less currents, not as deep, minimal wave influence, not as cold, easier surface connection for tether, air, communications, or measurements data transfer. Unlike the offshore diver, the waterfront diver has more flexibility and opportunity to concentrate his energy and thoughts on the in-situ structure evaluations. The less demanding diving conditions usually will allow the use of divers who are structural engineers first and divers second for at least those times when non-engineer divers find suspected deterioration warranting more expert scrutiny.

At the present there are no standard requirements for U/W inspections of fixed structures in common usage by United States industry or the federal or state governments. The American Bureau of Shipping (ABS) and the American Petroleum Institute (API) have generated flexible guidelines for offshore structures. These are a starting point for negotiations between diving companies and facility operators who formulate U/W inspection programs to satisfy the unique characteristics of each structure.

No comparable guidelines have been generated for waterfront facilities. The field of commercial U/W services is highly competitive with many small diving companies utilizing a wide range of procedures,techniques, and equipment and producing data records and structural evaluations at various technical levels. These companies tend to be highly motivated to experiment and develop their own individual inspection procedures, techniques, and even equipment. These unique capabilities may apply to such areas as pile cleaning, turbid water viewing, U/W photography, U/W TV, corrosion identification and measurement, statistical sampling selection, data recording, analysis of pile load capability for steel, concrete, and wood, and documentation drawings. Any significant advances in capability which may occur are considered proprietary so that it is difficult to know at any time what the state-of-the-art (SOTA) of U/W inspections may really be.

Since the Navy has had no standards for U/W inspections they have either been performed according to whatever directions each PWO felt qualified to provide or the PWO has left it mostly to the A&E's judgement to determine. This has resulted in the Navy's UWWFs being U/W inspected in a myriad of ways with a great variety of reports generated assessing facility conditions in varying levels of detail. The differences between these reports may be as great as the number (256) of activities that have these UWWFs. These differences are found in at least the following areas:

- type inspection - swim-by, simple measurements, with or without cleaning, detail measurements
- level of inspection detail - Level I, II, or III or combinations
- piles cleaned - total quantity, number of places per pile, cleaned area per pile, elevations of cleaned areas, bare or bright metal
- cleaning methods - hammer and chisel, hydraulic grinders, brush, scraper, water jet

- o diver qualifications - structural engineer, PE, NAUI, mixed gases
- o structural analysis - none, detailed calculations, vertical and lateral load capabilities
- o data recordings - type, quantity, format
- o M&R cost estimating - none, ballpark, detailed
- o inspection equipment - types (dive, measure, record data, photo, TV)

One problem experienced by CHESDIV as a result of this lack of standards has been in the area of evaluating inspection data from A&E reports outside of this program. Without uniformity of requirements, performance analysis or reporting there has been very little commonality of U/W inspections upon which to base comparative data on thousands of facilities around the world. Two A&Es assessments on similar or even the same structures cannot usually be compared. Until common standards or at least guidelines are used in all of the U/W inspections of the Navy's UWWFs an effective UWWF inventory data base cannot be established.

In the first two years of this program, CHESDIV's conduct of U/W inspections on 127 facilities required generating many Scopes-of-Work (SOW) for a number of different dive teams employing different techniques, equipment, etc. CHESDIV allowed the A&E's considerable latitude in the methods used to obtain the data required and to assess the physical condition of the facilities inspected. Each inspection has involved some technical considerations different from those of the other inspections. CHESDIV has kept an open mind in evaluating the effectiveness of these techniques, procedures, etc., and has factored this into the development of maximum uniformity between SOW generated for successive inspections.

While the SOW have varied some for each inspection there has been enough commonality to enable the SOW to be written in two parts - one in a standard manner for all inspections and the other part in a standard format with its content adjustable to the special characteristics of each individual inspection. This is illustrated in the sample SOW included in Appendix A. A major difference in this SOW from ones used earlier in the program is the change in the definition of levels of U/W inspection. The original two-level definition was changed to Levels I, II, and III and defined in more detail than previously. As in the past, none of these standards are considered necessarily final. This technology

is growing rapidly and requires constant tracking and evaluation to take advantage of newly developing capabilities. Considering the escalating costs, it is imperative that more efficient techniques and equipment be utilized as rapidly as they can be recognized as such. To do this, the program has to continue to be very flexible and adaptable to changes in guidance and operation.

One requirement which CHESDIV standardized early was the format for the inspection report which is included in Appendix B. This format has been included in the SOW for the inspections of probably 100 facilities to date.

At present, the planning of each inspection starts with the application of previously used procedures as much as possible in efforts toward achieving uniform inspection requirements. However, there have been sufficiently different factors and circumstances associated with most facilities as to cause the inspections to differ from each other to some degree. Despite this, there has been some narrowing of the criteria considered, and a practical feel is being developed for the priorities of these criteria.

Figures 6-1 and 6-2 represent the kinds of categorizing and prioritizing of inspection planning criteria which are being done lately in attempts toward developing a range of standard inspection scenarios. The objective is to have scenarios representative of every significant combination of major facility inspection criteria. Obviously subjective decisions, based on applicable experience, are required to limit the criteria so that the combinations of criteria do not form an unmanageably large number of scenarios. For each of the selected scenarios, definitions will be established for all the inspection requirements - techniques, data, cleaning, numbers of piles inspected at what levels, etc. Figure 6-3 outlines a first attempt at defining one of the 24 scenarios tentatively derived in Figure 6-2. These requirements definitions will be elaborated on and added to so as to become the basis for a scope-of-work covering one of the total numbers (24 at this time) of combinations of criteria into which all major criteria will have been divided. Ultimately, with inputs from NCEL, UCTs, EFDs and numerous A&Es a family of scenarios will be developed which will have been tested in actual inspections to prove their applicability and effectiveness.

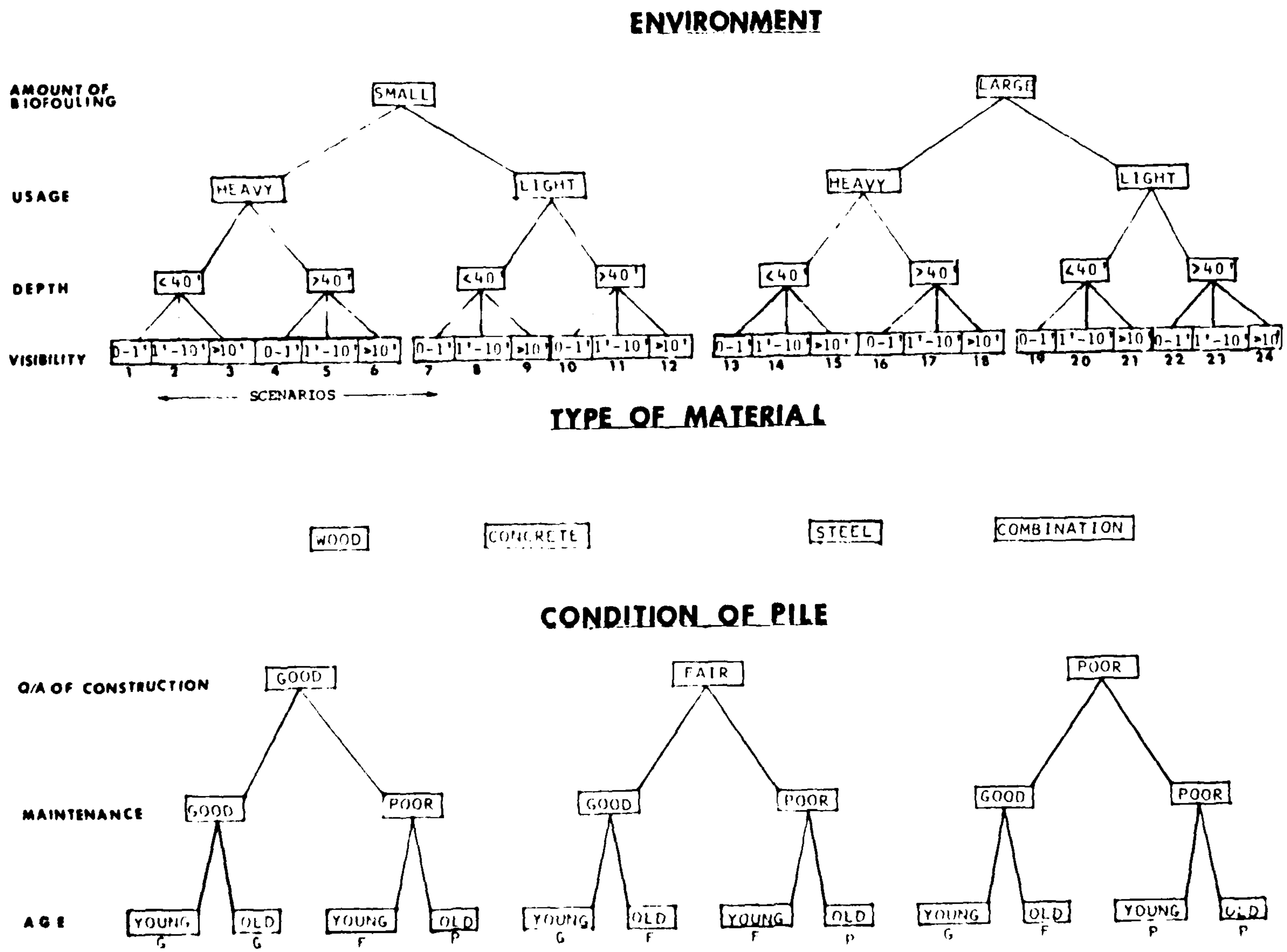


Figure 6-1 U/W Inspection Criteria

Figure 6-2

U/W INSPECTION CRITERIA DEFINITIONS

CONDITION	RATING	EXPLANATION
BIO FOULING (GROWTH)	SMALL AMOUNT	LITTLE OR NO CLEANING NEEDED BEFORE MEASUREMENTS
	LARGE AMOUNT	TIME AND EFFORT REQUIRED TO CLEAN SO MEASUREMENTS CAN BE TAKEN
USAGE	HEAVY	MORE INTERFERENCE WITH INSPECTION MORE DAMAGE LIKELY MORE TIME REQUIRED TO COMPLETE INSPECTION
	LIGHT	LESS OBSTRUCTIONS FOR INSPECTION DAMAGE MAY BE LESS
DEPTH	<40'	NO SPECIAL EQUIPMENT, JUST OBSERVANCE OF TIME LIMITS
	>40'	DECOMPRESSION MAY BE NEEDED
VISIBILITY	0-1'	LIMITED TO TACTILE INSPECTION
	1'-10'	CAN USE SPIRAL INSPECTION NEXT PILE MAY NOT BE SEEN
	10'	SWIM BY IN LAYERS, FASTEST
Q/A OF CONSTRUCTION	GOOD	DESIGNED AND BUILT TO LAST
	FAIR	DESIGN OR CONSTRUCTION DOES NOT WITHSTAND TIME
	POOR	DESIGN AND CONSTRUCTION ARE NEITHER EFFICIENT NOR FOLLOW STANDARDS
AGE	YOUNG	DEPENDANT ON MANY VARIABLES, PARTICULARLY TYPE OF MATERIAL
	OLD	DEPENDANT ON MANY VARIABLES, PARTICULARLY TYPE OF MATERIAL
MAINTENANCE	GOOD	FENDERING SYSTEM AND GENERAL REPAIRS KEPT UP
	POOR	NO REPAIRS, PIER DAMAGED

Figure 6-3

Provisional U/W Inspection Scenario No. 3

Criteria for Scenario No. 3

Amount of Biofouling	- Small
Usage	- Heavy
Depth	- < 40'
Visibility	- > 10'
Condition of piles	- good
Type of material	- steel

Equipment list:

- ultrasonic thickness gauge
- calipers
- underwater camera with strobe
- dive lights
- 200 ft fiberglass tape
- 6 ft folding rule
- chipping hammer and chisel
- dive knives
- pit gauge

Procedure:

Two divers and one tender - take soundings along pier

Level I - divers swim-by - 10 ft from surface one diver, 20 ft below him second diver

Note any abnormalities of all the perimeter piles and ___% of the bents

Level II - ___% of piles and any damaged piles found in Level I inspection - 1 ft wide bands, cleaned to base metal at areas of maximum corrosion: mean low water, within 2 ft of mudline, center of splash zone, and in areas where a differential oxygen concentration cell is set up (interface between concrete and steel)

Metal thickness measured with an ultrasonic thickness gauge and calipers - 20 photographs taken of significant damage.

Minimum measurement of flaws taken with rule and pit gauge

7. STANDARDS FOR COST ESTIMATING

In the first stage of this program, cost estimates were made and summarized for different types of U/W inspections for use as a guide in obtaining the government cost estimates required in contracting every U/W inspection with an A&E. Now the same type cost guides have been reestimated based on actual costs experienced in the program over the past two years and projections based on related experience gained in that period.

Figures 7-1 through 7-6 indicate, for pier inspections, the range of costs per pile for various periods of inspection. The costs includes all field work, structural analysis, report writing, travel, per diem - in other words, all aspects of the inspection task. Separate cost curves in each figure are drawn for steel, concrete and wood, and each of the six figures represents a different A&E contractor. It can be readily seen in these figures that the inspection costs for each material vary greatly between contractors because of the different techniques and equipment used. This is one of the reasons it is very difficult to standardize either working methods or resulting costs. Of course it would require evaluation of the relative effectiveness of the various techniques, equipment, etc., to be able to compare their relative worth. In effect CHESDIV is doing this in the normal operation of the program. Decisions are made in writing each Scope of Work to achieve increasing commonality between inspections. This leads toward more uniformity of inspection performance and thus more uniformity of cost estimating.

Toward that end, Figures 7-7 through 7-9 were drawn as compilations of the various contractors' inspection costs categorized by type of pile materials. There were many reasons for the wide range of inspection rates (piles/day) for Level I and Level II types. This is an area in which it is necessary to categorize the numerous inspection requirements so as to reduce the number of options considered for types of inspections, equipment used, types, amount, and locations of pile cleaning and data measurement, etc. As criteria ranges narrow, it should be possible to reduce the number of inspection scenarios described in Section 6 to a point where the accompanying costs, as reflected in Figures 7-7 through 7-9, will be more uniform and comparable. The derivation of the these cost estimating curves is explained further in Appendix C.

The experience of the last two years of concentrated CHESDIV U/W inspection effort provides a solid basis for further developing the initial work described in this report toward the establishment of practical UWWF inspection standards.

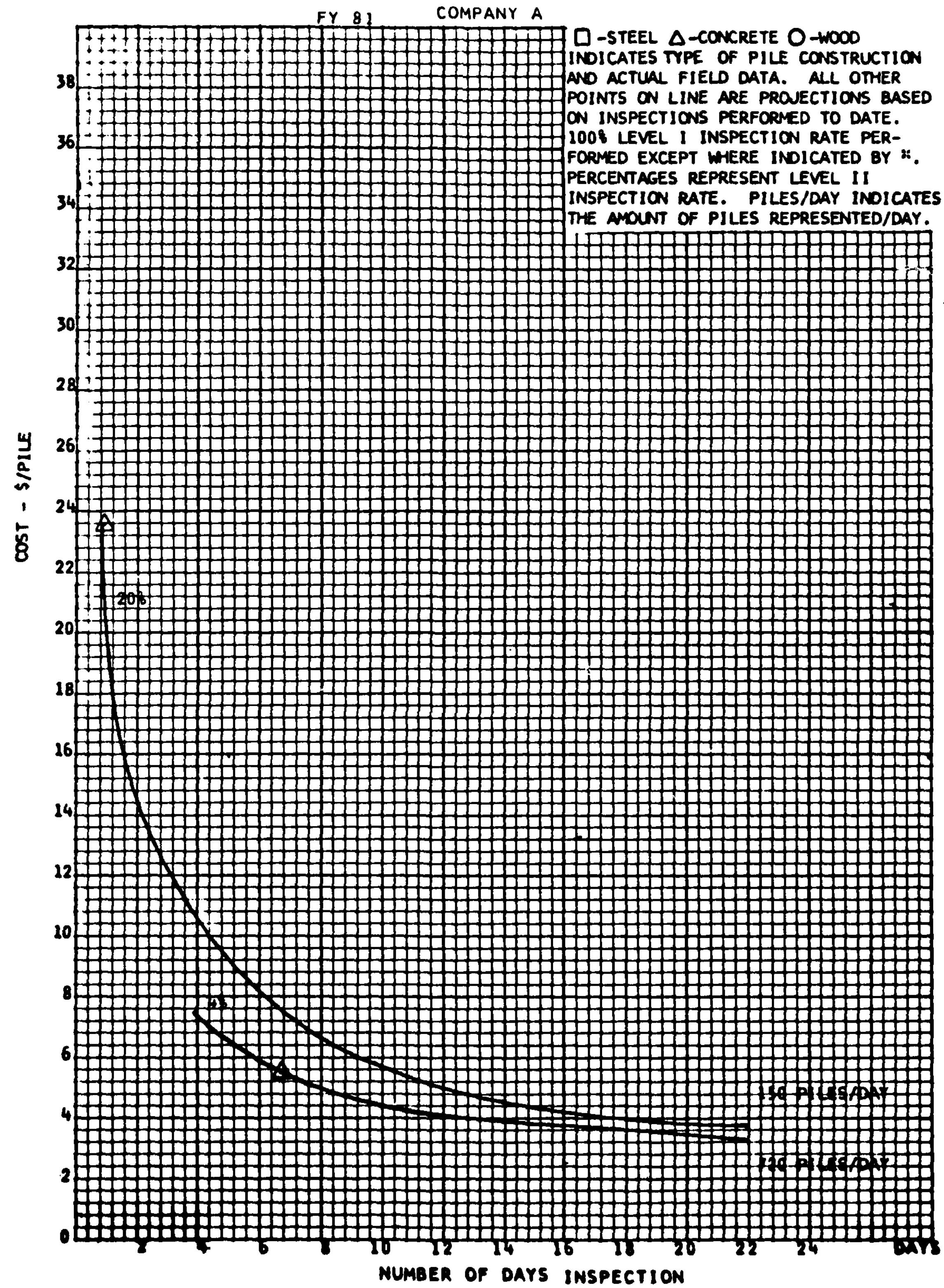


Figure 7-1

Company A U/W Inpection Costs

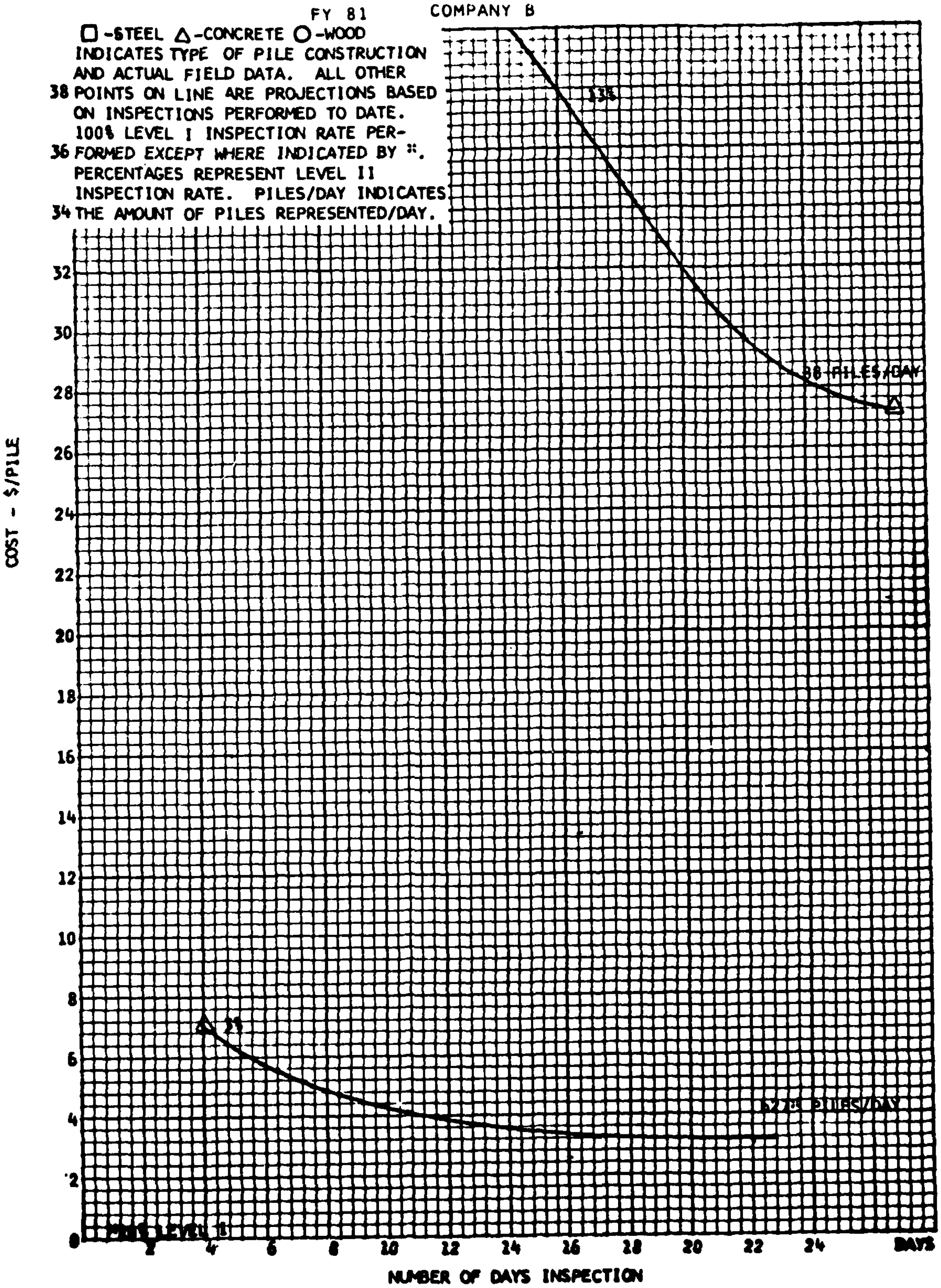


Figure 7-2

Company B U/W Inspection Costs

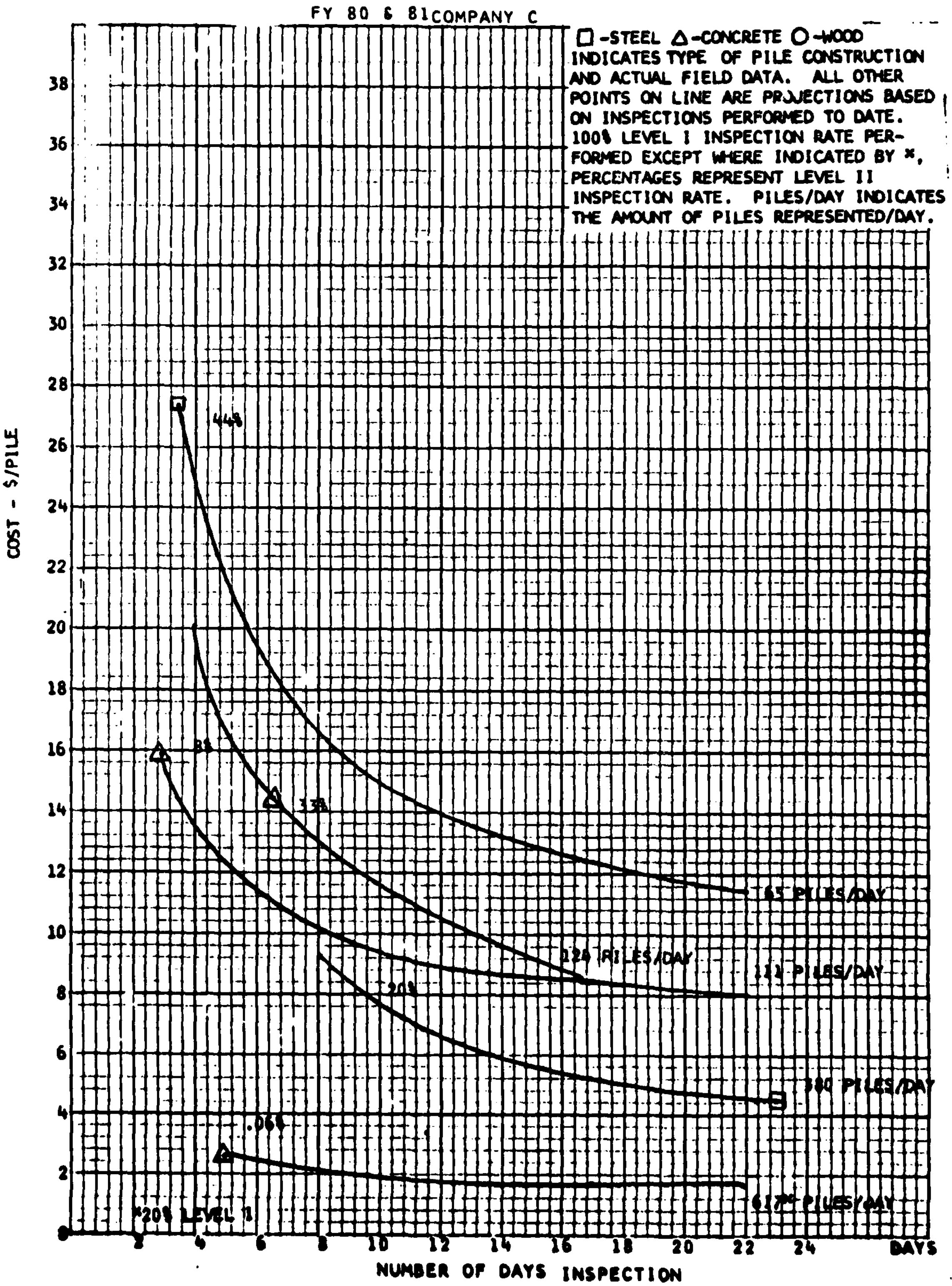


Figure 7-3

Company C U/W Inspection Costs

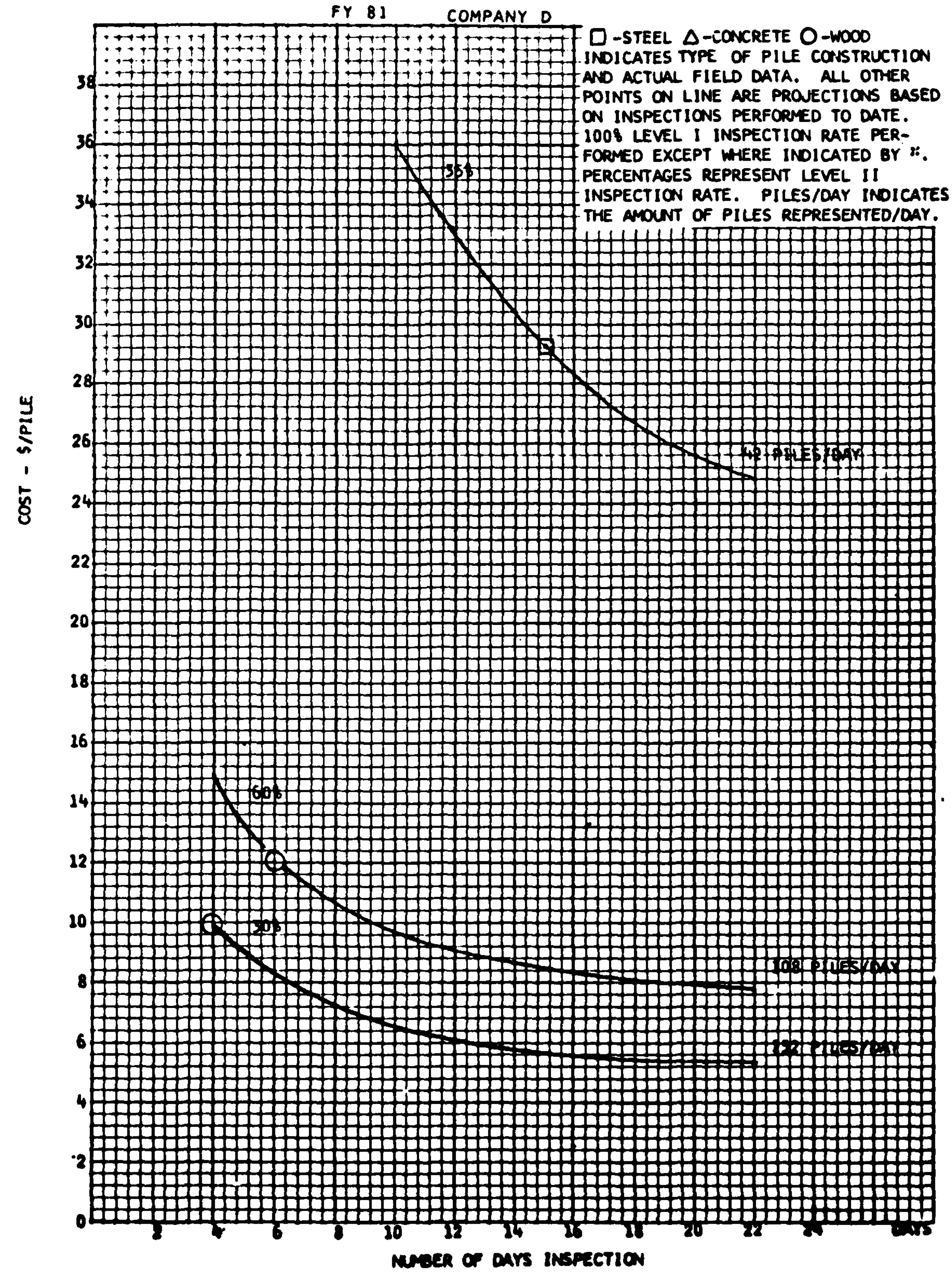


Figure 7-4

Company D U/W Inspection Costs

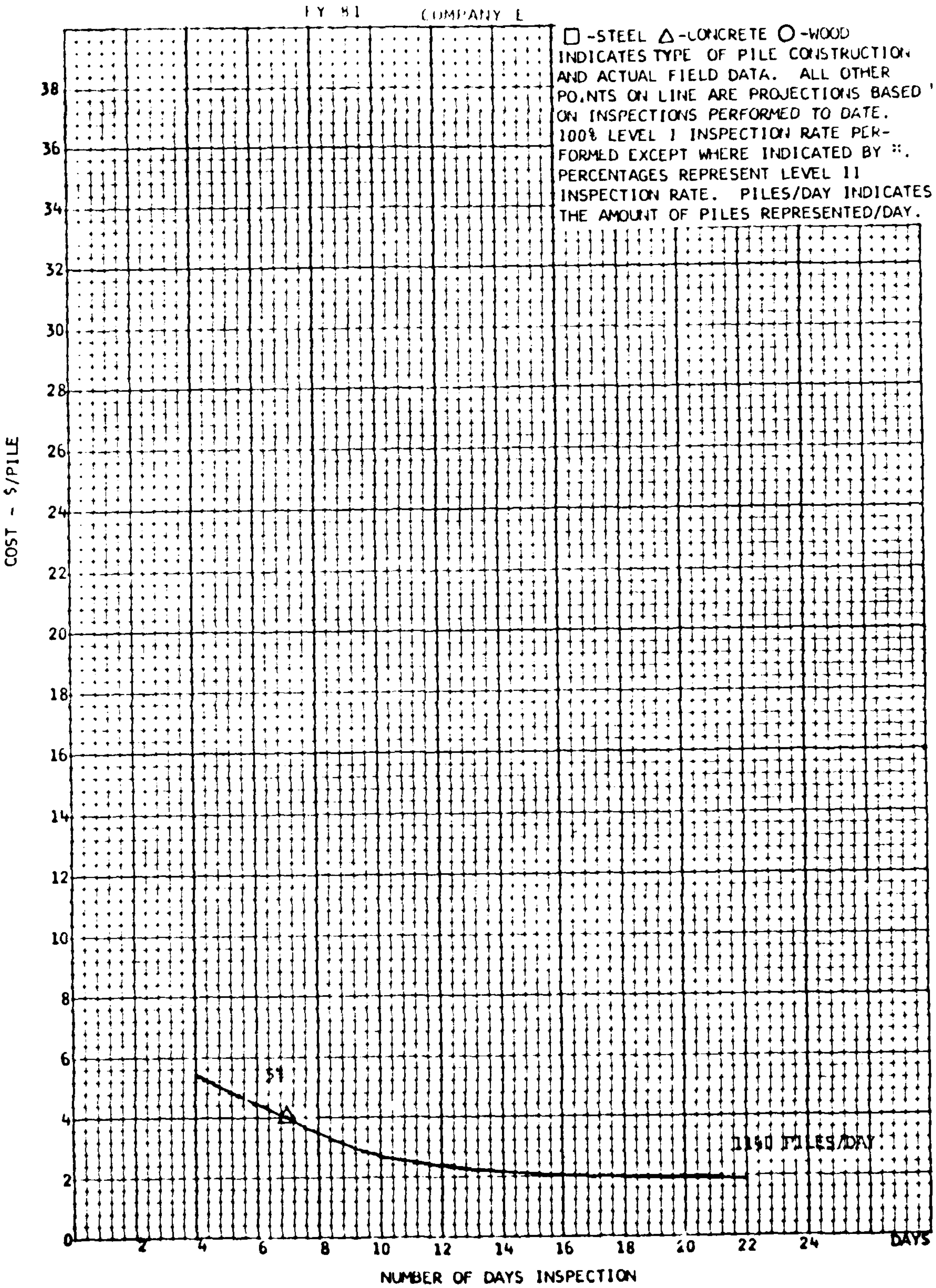


Figure 7-5

Company E U/W Inspection Costs

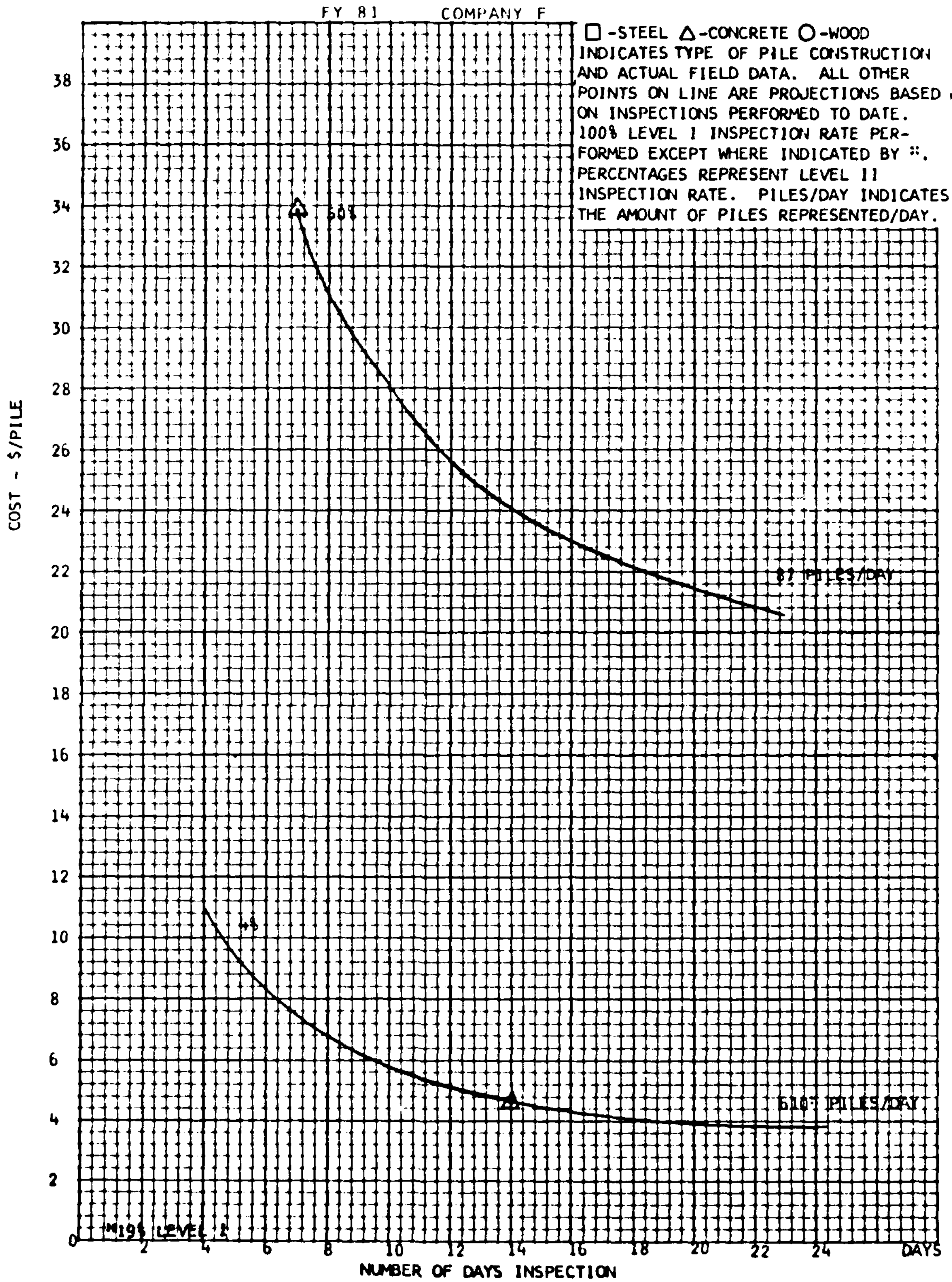


Figure 7-6

Company F U/W Inspection Costs

Figure 7-7

UNDERWATER INSPECTION COST

CONCRETE PILES

(FY 80 AND FY 81)

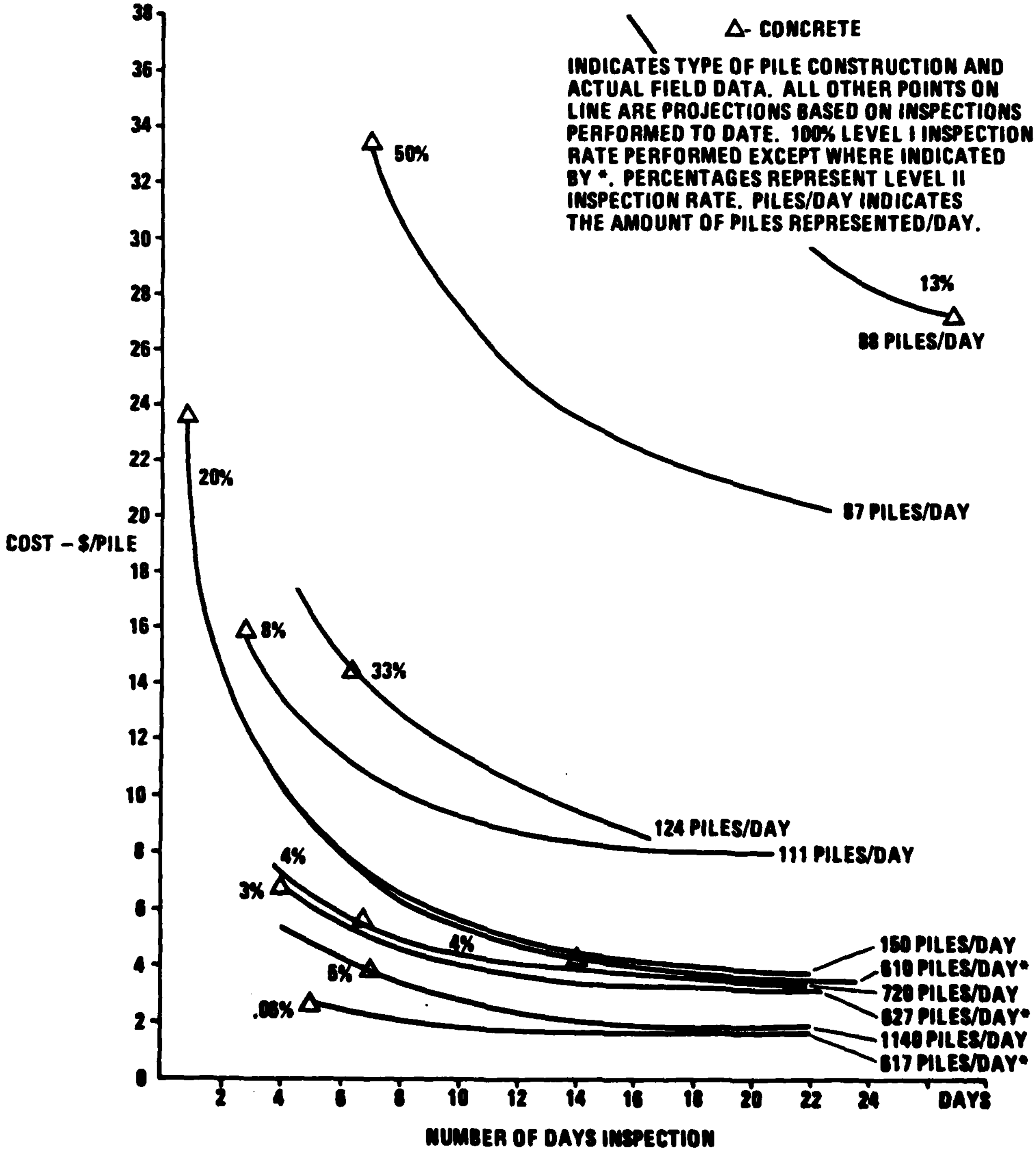


Figure 7-8

UNDERWATER INSPECTION COST

WOOD PILES

(FY 80 AND FY 81)

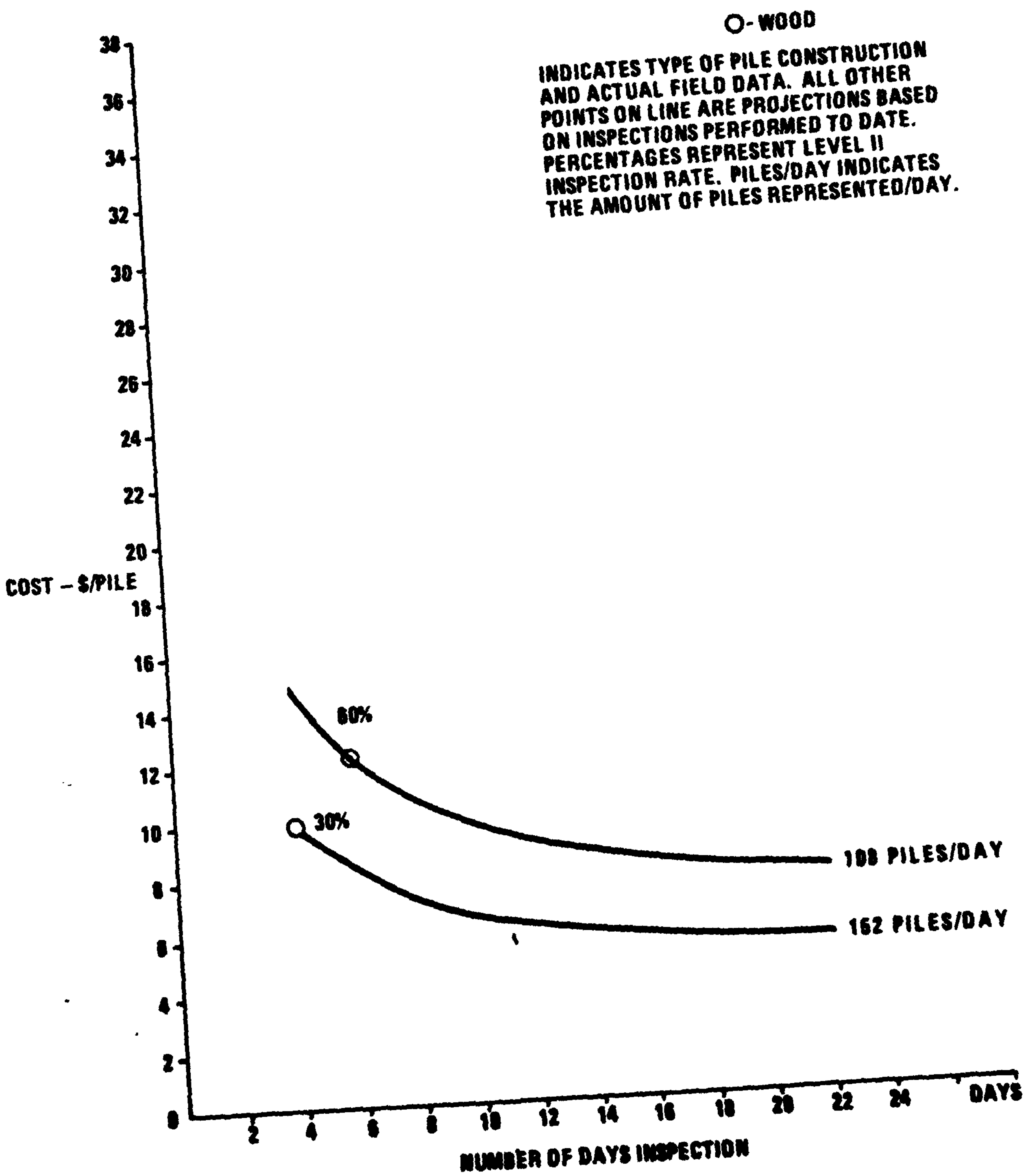
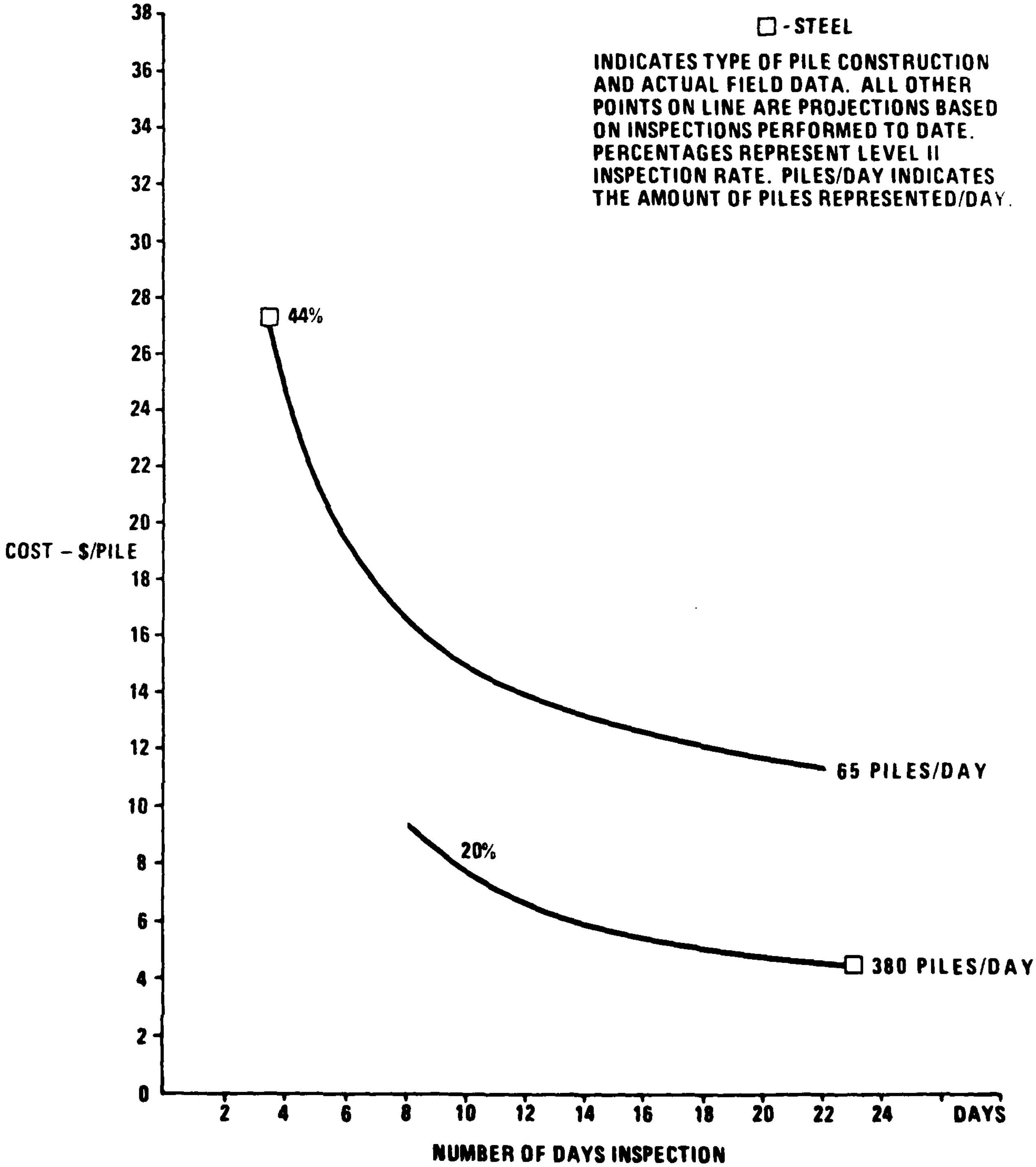


Figure 7-9

UNDERWATER INSPECTION COST

STEEL PILES

(FY 80 AND FY 81)



8. UNDERWATER WATERFRONT FACILITIES DATA INVENTORY

The data inventory system for the UWWFs which the program initially established and presently maintains on a manual basis is described in Section 3 as only the first, basic step toward an efficient computerized data management system. Such a system will provide the cost effective capabilities this program requires in speed and versatility of data processing, storage, retrieval, and analysis

The Underwater Waterfront Facilities Inventory System will be an information management tool specifically tailored to the needs of the Underwater Inspection Program. Initially it will contain data on the identification, location, description, and history of approximately 1,200 waterfront facilities.

The system will be centered around a generalized data base management program as indicated in Figure 8-1. These programs are readily available on nearly all computer time-sharing services. The use of a data base management program will reduce development time and cost for the system as well as making the system easier to operate and maintain.

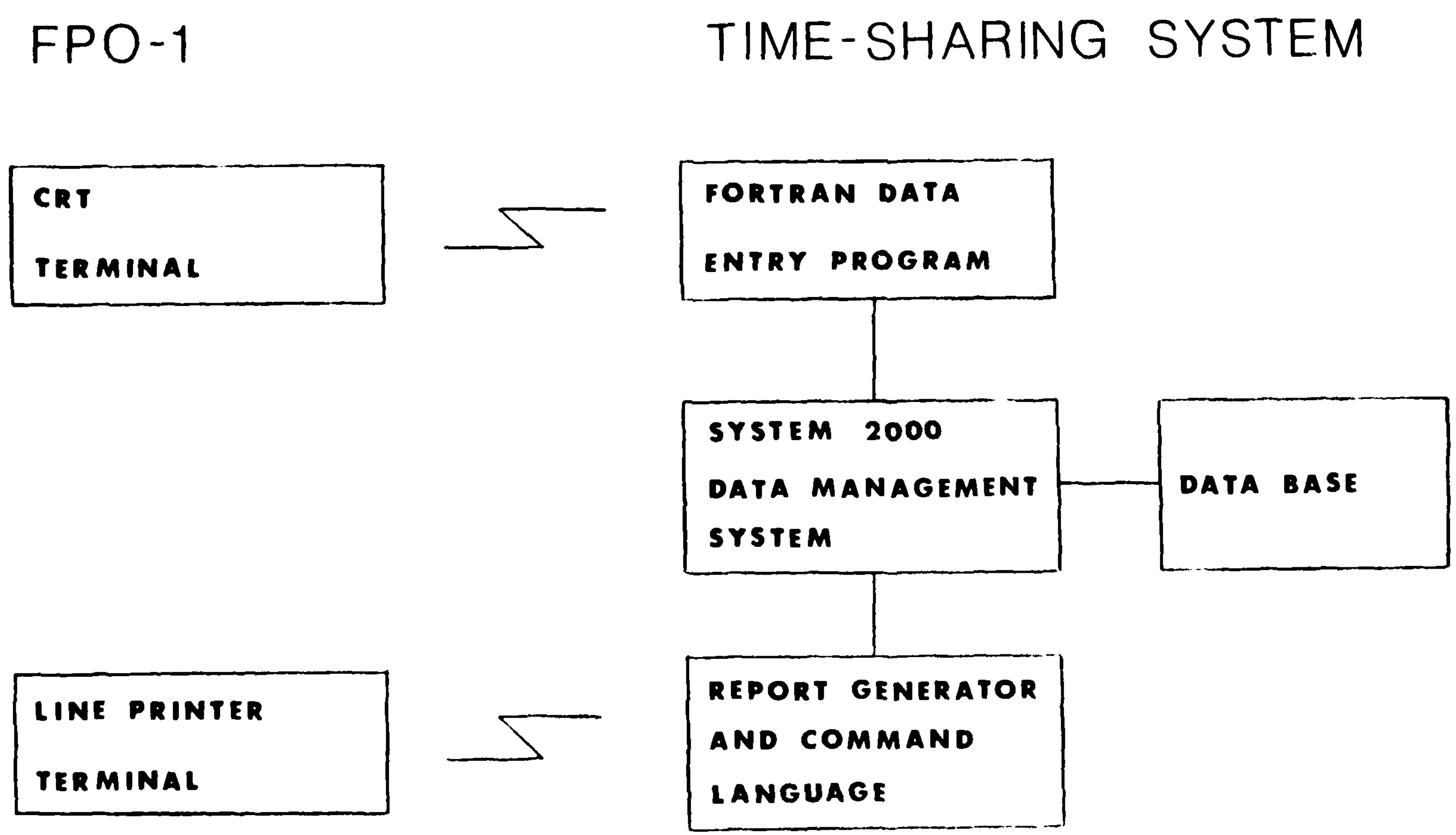
The required data print-out format was developed to provide the basic data in convenient hard copy size including 132 characters per line as illustrated in Figures 8-2 and 8-3.

The proposed system was discussed with data management specialists from the two computer time-sharing services presently under contract to this office. Both agreed that the proposed system was well within the capabilities of the generalized data base management programs their companies offered.

Based on these meetings, it was estimated that implementation of the Waterfront Facilities Inventory System would require five man-months of labor and cost $40,000 (Appendix D). Implementation can proceed as soon as funding is provided.

Figure 8-1

WATERFRONT FACILITIES INVENTORY SYSTEM



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1  WATERFRONT FACILITIES INVENTORY SYSTEM          DATE DD-MMM-YY                                                    PAGE 12
5  *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **
   GEOG AREA 12  ACTIVITY UIC 123456  LIST 1  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **  **
   SPECIAL AREA 12  XXXXXXXXXXXXXXXXXXXXXXXXXX
3  *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
   CAT CODE 123456  XXXXXXXXXXXXXXXXXXXXXXXXXX

   FAC       PF        LOCAL     YEAR  CPV     LENGTH-WIDTH-AREA    OTHER UNIT  W    T    PILES              TYPE  LAST INSP     N
   NUMBER    NUMBER    NAME      COMP  ($000)  (FT   (FT)    (FT)   OF MEASURE  D    R    REAR-BAT-FEND      MATL  DATE-L-B-C    I
2  1234567   12345678  12345678  1234  123456  123456-123-123456    1234567890  123-12    12345-123-123      1234  1234-1-1-1    12
   1234567   12345678  12345678  1234  123456  123456-123-123456    1234567890  123-12    12345-123-123      1234  1234-1-1-1    12
   1234567   12345678  12345678  1234  123456  123456-123-123456    1234567890  123-12    12345-123-123      1234  1234-1-1-1    12
   1234567   12345678  12345678  1234  123456  123456-123-123456    1234567890  123-12    12345-123-123      1234  1234-1-1-1    12
   1234567   12345678  12345678  1234  123456  123456-123-123456    1234567890  123-12    12345-123-123      1234  1234-1-1-1    12

   CAT CODE 123456 TOTAL               123456             123456    1234567890            12345-123-123

   SPECIAL AREA 12 TOTAL               123456             123456    1234567890            12345-123-123

   ACTIVITY UIC 123456 TOTAL           123456             123456    1234567890            12345-123-123
```

1 A LINE FOR EACH PAGE

2 A LINE FOR EACH FACILITY

3 A SECTION FOR EACH CATEGORY

4 A SECTION FOR EACH AREA

5 A SECTION FOR EACH ACTIVITY

Figure 8-2 Sample Data Output Format

Figure 8-3

Glossary For Sample
Data Output Format

FAC NUMBER:	Facility Number
PR NUMBER:	Property Record Number
LOCAL NAME:	Same
YEAR COMP:	Year Completed
CPV:	Current Plant Value
LENGTH:	Same
WIDTH:	Same
AREA:	Same

OTHER UNIT OF MEASURE:

WD:	Water Depth
TR:	Tidal Range
PILES BEAR:	Bearing Piles
BAT:	Batter Piles
FEND:	Fender Piles
TYPE MATL:	Material type
LAST INSP DATE:	last Inspection Date
L:	Level of Inspection
B:	By
C:	Condition
NI:	Next Inspection

APPENDIX A

Typical Scope of Work for Ocean Engineering Services in Support of Underwater (U/W) Facility Assessments at Various Locations

20 October 1981

OCEAN ENGINEERING SERVICES
IN SUPPORT OF
UNDERWATER (U/W) FACILITY ASSESSMENTS AT VARIOUS LOCATIONS

CONTRACT N62477-81-C-0448
SCOPE OF WORK

I. GENERAL REQUIREMENTS:

A. Project Definition:

1. This is a task oriented engineering services contract in support of inspection, analysis, and recommendation of repairs of the submerged portions of several Navy waterfront facilities. The work will require expertise in underwater inspection, damage and deterioration assessment, repair analysis, and cost estimating.

2. The first specific task to be performed under this scope of work is described in paragraph II, "Specific Requirements". Subsequent tasks will be described in paragraphs III, IV, V, etc..

3. At the Government's option, additional work similar in scope and magnitude may be added to this contract at any time within 1095 calendar days from the effective day of this contract. The service fee for any one tasking shall be limited to no more than the total service fee which shall not exceed $450,000.00. A separate fee will be established for each/any subsequent task.

B. Administrative Procedures and Instructions:

1. All correspondence shall be addressed to the Commanding Officer, Chesapeake Division, Naval Facilities Engineering Command, Building 212, Washington Navy Yard, Washington, DC 20374 with attention: Code FPO-1, and should include four (4) extra copies. The contract number shown in the heading of this Scope of Work is the number assigned to the Engineering Services Contract for this work and shall be used on all billings, reports and correspondence relative to this contract, together with any applicable contract modification number.

2. As soon as possible after award of this contract, a task-oriented conference will be held, at which time the contractor will be given the opportunity to discuss the task and resolve any questions regarding the scope of work.

3. Field investigation made by the contractor will normally involve diving operations and will include a thorough check of underwater conditions as well as other conditions pertinent to the proposed work. All diving operations will be conducted in accordance with best commercial safety standards as appropriate. Information relative to existing conditions at the site will be made available to the contractor who shall evaluate and verify such information to the extent that it is necessary to perform the work stated herein.

C. Criteria:

1. The contractor is responsible for the professional quality of his submittals including editing, checking and reproducibility.

2. Specific report format and other criteria will be established by the Government for each task, as required, using "example documents" or by specifying established criteria.

D. Studies, Analyses, Miscellaneous Requirements:

1. Levels of Inspection:

The following levels of inspection are to be construed only as general guidelines and not specific task procedures. Within the description of any specific task, the level and complexity required in an inspection will probably be a blend or combination of the different levels of inspection. Specific task descriptions will use these definitions as a reference.

Level I: General Inspection: This type of inspection is essentially a "swim-by" overview, which does not involve cleaning of any structural elements, and can therefore be conducted much more rapidly than the other levels of inspection. The Level I inspection should confirm as-built structural plans and detect obvious major damage or deterioration due to overstress (collisions, ice), severe corrosion, or extensive biological growth and attack. The underwater inspector shall generally rely primarily on visual and/or tactile observations (depending on water clarity) to make condition assessments. These observations are normally made over the specified exterior surface area of the underwater structure whether it is a quaywall, bulkhead, seawall, pile, or mooring. Visual documentation (utilizing underwater television and/or photography), may be included with the quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

Level II: Detailed Inspection: This type of inspection is directed toward detecting and describing damaged/deteriorated areas which may be hidden by surface biofouling or deterioration and toward obtaining a limited amount of deterioration measurements. These data should be sufficient to enable gross estimates to be made of facility load capability. Level II inspections will often require cleaning of structural elements. Since cleaning is time consuming it is generally restricted to areas that are critical or which may be representative of the entire structure itself. The amount and thoroughness of cleaning to be performed is governed by what is necessary to discern the general condition of the overall facility. Simple instruments such as calipers, measuring scales, and ice picks are commonly used to take physical measurements. However, a small percentage of more accurate measurements may also be taken with more sophisticated instruments for several reasons. These measurements will validate large numbers of simple measurements and in some hard-to-measure areas will actually be easier and faster to obtain. Where the visual scrutiny, cleaning, and/or simple measurements reveal extensive deterioration, a small sampling of detailed measurements will enable gross

estimates to be made of the structure's integrity. For example, on extensively corroded steel H-piles a small percentage should receive ultrasonic thickness measurements to determine typical cross-section profiles. The cross-sections determined by these spot checks would be used to determine individual H-pile load capability which would then be extrapolated to obtain a "ballpark" estimate of overall facility load capability. Visual documentation (utilizing underwater television and/or photography) should be included with the quantity and quality adequate to be representative of the range of facility damage/deterioration.

Level III: Highly Detailed Inspection: This type of inspection will often require the use of Non-Destructive Testing (NDT) Techniques, but may also require the use of partially destructive techniques such as sample coring through concrete and wood structures, physical material sampling, or in-situ surface hardness testing. The purpose of this type of inspection is to detect hidden or interior damage, loss in cross-sectional area, and material homogeneity. A Level III inspection will usually require prior cleaning. The use of NDT techniques are generally limited to key structural areas, areas that may be suspect or to structural members which may be representative of the underwater structure. Visual documentation (utilizing underwater television and/or photography) and a sampling of physical measurements should be included with quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

The general pattern of the inspection to be followed, and the specifics of a particular inspection such as location of individual piles to be examined will be determined by mutual agreement between the contractor and the Government.

2. Repair and Cost Analysis:

If the underwater inspection has revealed significant damage, a gross assessment of repairability should be performed. This analysis takes into consideration life cycle costs for various repair techniques as well as structural considerations in recommending particular repair techniques. An important component of a repair analysis that should be included is an order-of-magnitude cost estimate for the total repair effort including design.

E. Progress Submittal Procedures and Submission Schedule:

1. Execution Plan:

An execution plan for accomplishment of each specific task shall be submitted two (2) weeks after contract or task award, for Government review. This plan shall briefly describe the inspection approach and provide a schedule for completion through the final report.

2. Inspection Commencement:

On-site inspection shall commence not later than six (6) weeks after award of contract. The actual inspection commencement date and inspection time period shall be established by mutual agreement between the contractor and Government.

3. On-Site Reporting:

Summary reporting in writing of the underwater inspection progress shall be provided to the on-site Government representative on a daily basis. A log shall be kept of all findings and shall be made available to the on-site Government representative for his perusal while on site. The log shall clearly reference the exact location of all observations, minimally showing relative elevation along the pile, water depth relative to mean low water, and position of the pile on the pier. One (1) legible reproduction of the log shall be delivered to the Government one (1) week after completion of the on-site inspection.

4. Final Report:

The results of the inspection and analysis shall be submitted in the form of a formal engineering report. The report shall clearly state the contractor's findings, and assessment with all back-up documentations. The report drawings of structural plan views should detail the pattern of inspection used and in the case of open type structures, such as piers, the pile plan will also indicate which piles were inspected and the level of detail of that examination (Levels I, II, or III). The level of detail and the format required are indicated on the sample table of contents for a previous report entitled "Underwater Inspection Report Format" (enclosure (1)). The report shall include a minimum of (20) color photographs (no xerox color copies) of 4" x 5" size. One (1) copy of a draft report shall be submitted four (4) weeks after completion of the on-site inspection. The Government will return the draft within three (3) weeks after its receipt with review comments for the contractor's consideration and modification of the report. Subsequent cycles of Government review and contractor modification of the report, if required, will be limited to three (3) week's effort on the part of each party. The contractor shall deliver a reproducible and ten (10) copies of the final report three (3) weeks after receipt of the Government's acceptance of a final draft.

F. Government-Furnished Information (GFI):

Prior inspection reports, if any, and available design and construction drawings for the facility will be provided to the contractor as government-furnished information. These documents are for contractor's information only. The contractor is responsible for his interpretation and subsequent use of this information. The Government project files for the respective facilities will be made available for the contractor's perusal. Access to the files shall be coordinated through the Chesapeake Division, Naval Facilities Engineering Command (FPO-1). GFI shall be returned to the Government after completion of the project.

G. Photographic Documentation:

Still photographs will be taken by the contractor regardless of the water clarity or visibility for incorporation in the final report. It is the responsibility of the contractor to provide the equipment (clear water box, close-up lens, etc.) necessary to meet this requirement. Photographs will be taken of damage/deterioration to structural members as well as typical conditions such as representative samples of piling at the mudline, splash or tidal zone and midway in between. It would also be appropriate to include photographs of typical or extraordinary marine biofouling deposits, pile splices or joints, cross-bracing, previous repairs, etc..

II. SPECIFIC REQUIREMENTS

A. Task No. 1.0

1. General

This task consists of engineering services necessary to achieve an assessment of the general physical condition of nine (9) piers and two (2) bulkheads at the Naval Station, Norfolk, VA. The facilities to be inspected are the following:

Facility	Size (lxw) (ft.)	Built	Total # of piles/ Lin. ft. of blkhd.	Water Depth (ft.) @ piles/@ blkhd.
2	1340 x 170	1943	4250	30 - 35
3	1307 x 170	1942	4300	30 - 35
4	1346 x 250	1942	2100/2760	30 - 35/9
22	1302 x 50	1944	935	30 - 35
23	1255 x 50	1944	902	30 - 35
25	1400 x 70	1977	1131	30 - 35
C	400 x 20	1952	140	30 - 35
D	400 x 20	1952	140	30 - 35
E	400 x 20	1952	140	30 - 35
CEP-102	Bulkhead	1943	/1750	/15
CEP-176	Bulkhead	1943	/900	/15
		TOTAL	14038/5410	

All piles are 18 inches square reinforced concrete. Pier 4 has concrete piles with steel sheet pile retaining wall to support the storage building. All other bulkhead is concrete sheet pile construction.

Assessment includes but is not limited to underwater inspection, engineering analysis of existing conditions, and previous inspection data and drawings of the facility, engineering calculations, recommendation of appropriate actions, and documentation of findings.

B. Task Description

1. Underwater (U/W) Inspection:

The contractor shall provide personnel and equipment necessary to perform an underwater inspection of the structures. The quality of inspection shall be such as to allow the contractor to assess the general physical condition of the substructure which is submerged and/or subject to frequent wetting by tidal or wave action. After first studying the GFI, the contractor shall perform a Level I general inspection on all exterior perimeter piles and every pile in every third bent (5685). A modified Level I, which is a "swim-by" of every pile at an elevation of two (2) to four (4) feet below the MLW to detect any obvious major damage, shall be conducted on all piles (7370).

A Level II detailed inspection of 7% of the bearing (885) and batter piles (98) shall be performed. This Level II inspection shall involve cleaning of the piles

chosen in the following manner: piles will be "band" cleaned of biofouling and debris on three (3) sides or faces of each pile to a length of ten (10) inches to expose the underlying pile for inspection. Two thirds (2/3) of all Level II piles (655) shall be inspected in the general area of MLW with the remaining third (1/3) at the mudline or mid-depth (327).

The Level II inspection for sheet pile shall be a detailed inspection performed every three hundred linear feet. For concrete sheet pile this Level II inspection means cleaning and observing a one (1) square foot area at three (3) elevations, mud line, mid-depth, and the general area about MLW. For steel sheet pile, this Level II inspection means cleaning and observing a six (6) square inch area and taking ultrasonic measurements at three (3) elevations, mudline, mid-depth, and the general area about MLW.

The specific elevations and locations of the piles (batter, bearing or sheet) to be inspected in detail will be determined by mutual agreement between the contractor and the on-site government representative. The following is a list of each facility to be inspected with the number of piles to receive a Level I and a Level II inspection:

	Piers									
Facility No.	2	3	4	22	23	25	C	D	E	TOTAL
Level I Piles	1593	1669	872	433	416	444	86	86	86	5685
Mod Level I Piles	2359	2330	1081	437	423	608	44	44	44	7370
Level II Piles	298	301	147	65	63	79	10	10	10	983
										14038

2. Assessment of Apparent Condition of Structure:

The contractor shall assess the structure's integrity as follows:

a. From the contractor's professional experience, training, and judgement, the contractor shall provide backup computations of loss in section, strength, and other characteristics that will quantify the assessment. The Government-furnished information and the data obtained in the underwater inspection portion of this work shall be used as additional basis for this assessment.

b. The results of this assessment shall be reported in terms of minimum cross-sections, equivalent effective cross-sections and attendent elastic properties such as section modulus, moment of inertia, and radius of gyration for these cross-sections. The assessment shall also result in the recommendation of any prudent temporary action that should be taken relative to any down-grading of the capacity of the pier prior to the corrective action such as repair of the pilings.

3. Recommendations:

The final task of the contractor shall be to provide recommendations for actions to be taken to insure long term cost effective maintenance and repair (M&R) and utilization of the inspected facility. These recommendations shall include the types of repairs required and budget level cost estimates for these repairs. They may take any one of several forms.

One recommendation would be based on the contractor finding the pier to be in apparent excellent condition. In this event, the contractor should propose only future periodic reinspections at specific intervals along with comparisons of a standardized format of inspection data.

Another recommendation would be a down-grading of facility load capability from design load. This would only be justified after a Level II or III inspection. Where a Level II inspection is used as a basis the approximations of load capability predictions and repair costs should be commensurate with the limited measurements taken.

The general intent of the recommendations is to provide the responsible activity with a quantified assessment of facilities physical conditions and order-of-magnitude estimates of repair costs which can be used to request M&R funding from his major claimant.

4. Completion Date:

Task No. 1 has a completion date of thirty-four (34) weeks after contract award.

APPENDIX B

Underwater Inspection Report Format

Cover (Gov't Furnished)

Title Page

Foreword

Executive Summary & Tabulated Summary Sheet

Table of Contents

List of Figures

List of Photographs

Section 1. Introduction

- 1.1 Task Description
- 1.2 Report Content
- etc.

Section 2. Activity Description (taken from Base Master Plan)

- 2.1 Location
- 2.2 Mission
- etc.

Section 3. Inspection Procedure

- 3.1 Level of Inspection
- 3.2 Inspection Procedure
- 3.3 Inspection Equipment

Section 4. Facilities Inspected

- 4.1 Fuel Pier
- 4.1.1 Description
- 4.1.2 Observed Inspected Condition
- 4.1.3 Structural Condition Assessment
- 4.1.4 Recommendations
- 4.2 Marginal Wharf
- 4.2.1 Description
- etc.

Section 5. Conclusions

Appendices

- Field Notes
- Backup for Cost Estimates
- Backup Computations of Structural Assessment
- etc.

APPENDIX C

Derivation of Cost Estimating Curves
for U/W Inspection of Waterfront Facilities

Derivation of Cost Estimating Curves for U/W Inspection of Waterfront Facilities

The cost estimating curves in Section 7 pertain to A&E firms contracted to perform the U/W inspections of Navy UWWF including gross structural assessments and written reports as described in Section 4 and in Section 7. Details of the derivation of these curves are provided here.

The cost/pile figure is obtained by dividing the contract price by the number of piles in the facility(ies) inspected (represented piles). This number is graphed vs. the number of days it took to complete the field work (actual inspecting of the piles). From this point on the graph, a projection of cost/pile versus number of days inspection is calculated in the following way:

1. The following numbers are found within the contract:

   a. Average hourly rate - average rate of dive team, tender, engineer or anyone else who is involved with the actual field work or inspection crew.

   b. Hours per day - eight hours is usual working day.

   c. Number of men in crew - as in (a) above.

   d. Number of piles per day - number of piles in facility divided by days of inspection.

   e. Cost of contract - includes report writing + drafting, transportation, per diem, direct labor, cost estimating, recompression time, etc. (A&E fixed fee negotiated contract).

   f. Number of piles in facility(ies)

2. A calculation of new (projected) points from data in (1) is produced for different number of days. Inspection as follows:

V - Average hourly rate X hours/days X number of men in crew

W - Difference of projected days of inspection from original days of inspection.

X - Number of piles per day

Y - Cost of contract

Z - Number of piles in facility

P - New cost per pile

$$\frac{V(W) + Y}{X(W) + Z} = P$$

Example:

Data from contract
number of piles - 334 piles
cost of contract - \$15.32K
cost/pile - \$15.94/pile
number of days inspection - 3 days
average hourly rate - \$31.50
number of men in crew - 3 men
pile/day - 111/day

To find cost/Piles for a 10 day inspection

V- \$31.50 X 8 hours/day X 3 men = \$756/day

W - 10 days - 3 days = 7 days

X - 111 piles

Y - \$15.32K

Z - 334 piles

$$P = \frac{V(W) + Y}{X(W) + Z} = \frac{\$756(7) + 5.32K}{111\ (7) + 334} = \$9.55/\text{pile}$$

\$9.55/pile vs. 10 days

Now two points can be plotted on a cost/pile vs number of days inspection graph; the original data point from the contract (\$15.94 vs. 3 days), and the projected point (\$9.55 VS 10 days).

After plotting a significant amount of additional projected points, a line can be drawn through them. When a number of these lines are drawn, an envelope developes showing that pile/day has significant importance to the cost/pile; as the piles/day becomes smaller, the cost/pile becomes larger. This proves the assumptions made forerunning the Underwater Pier Inspection Program. Each contractor is represented on it's own graph because of varied costs of direct labor, overhead, profit rates etc due to differences in techniques and equipment used.

AD-A163 526 U/W (UNDERWATER) INSPECTION PROGRAM STATUS REPORT(U) 2/2
NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON DC
CHESAPEAKE DIV P T SCOLA DEC 81
UNCLASSIFIED CHES/NAVFAC-FPO-1-81(25) F/G 13/2 NL

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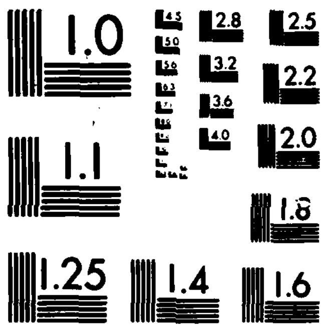

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX D

Reference for Cost of Computerized Data System

FPO-1EA5
11000
SEP 3 '81

From: Commanding Officer, Chesapeake Division, Naval Facilities Engineering Command
To: Commanding Officer, Atlantic Division, Naval Facilities Engineering Command

Subj: Waterfront Facilities Program, Data Base Management System for

Ref: (a) Meeting between Mr. W. Gasser (LANTNAVFACENGCOM Code 10253) and Mr. A. Del Collo (CHESNAVFACENGCOM Code FPO-1EA5) of 24 July 1981

1. Reference (a) requested a cost estimate for the implementation of a computerized data base management system for use by the Waterfront Facilities Program. The estimated cost for the system is $38,000.

2. This estimate includes the cost of designing the data base, developing the required computer programs and procedures, and entering the data into the computer.

D. E. MORRIS
By direction

Copy to:
FPO-1EA
FPO-1EA5
Daily
Route
0161(2)

Prepared by: A. Del Collo:dmc 33581 2 SEP 81

END

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3-86

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